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Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

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Westlink Goes Under

A major ham newsletter has bitten the dust after 13 years and 330 issues. Publisher Burt Hicks WB6MQV announced that the January 1, 1995, issue of the *Westlink Report* would be the last. "I would like to think that what we have done in the past thirteen years has made a difference for good in the hobby. We know we have influenced some decisions of the Federal Communications Commission as well as informed a few members of Congress, and perhaps helped shape the public debate on issues of interest to amateurs," said Hicks.

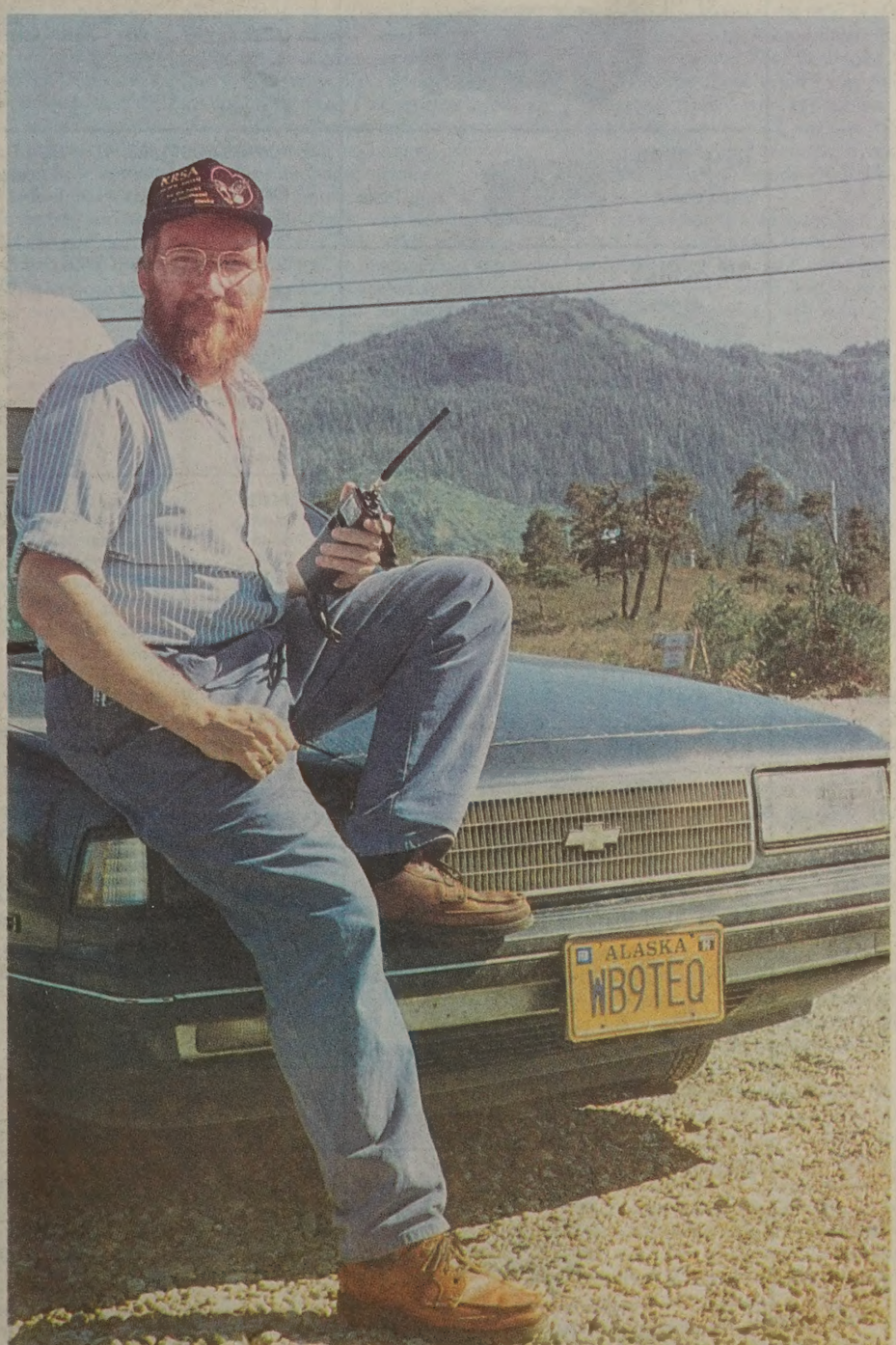
The demise of *Westlink* is not a total surprise. The newsletter has been fighting a well-known financial struggle for about eight years. But Hicks says it was lack of ZZZs rather than lack of $$$s that finally caused Westlink to fold. He says four to five hours of daily sleep is simply not enough to keep publishing *Westlink* while working the graveyard shift as a Fox Television Engineer. There are only two other national newsletters comparable to the *Westlink Report*: the *ARRL Letter* and the *W5YI Report*. Hicks calls the League's newsletter "professionally done," but adds that it lacks editorial freedom. The *W5YI Report*, on the other hand, had only three amateur radio stories in the last issue received. *W5YI* was also responsible for erroneous reports of a major financial disaster here at Wayne Green Inc. The *W5YI Report* based that story on interviews with disgruntled former WGI employees. *TNX Westlink Report, No. 687, January 1, 1995.*

FAR Scholars Sought

The nonprofit Washington, D.C., based Foundation for Amateur Radio will once again coordinate the distribution of 56 scholarships from a variety of donors for the academic year 1995-96. Licensed radio amateurs may compete if they plan to persue full-time studies beyond high school and are enrolled or have been accepted for enrollment at an accredited university, college, or technical school.

The FAR Scholarships range in value from $500 to $2,000 each. Some have restrictions. More information and an application form may be requested before April 30, 1995, from *FAR Scholarships, 6903 Rhode Island Avenue, College Park, Maryland 20740. TNX W5YI Report, January 15, 1995.*

Alaskan Amateurs



Here's Dan WB9TEQ, in Petersburg, Alaska. Hams and their vehicles are a welcome sight in the land of the midnight sun, where telephones can be many miles away. Turn to our special photo essay on page 8. (Photo by George Pataki WB2AQC.)

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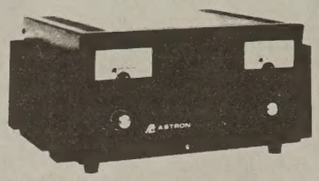

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SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

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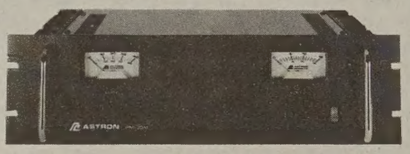
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



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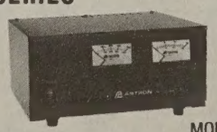
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

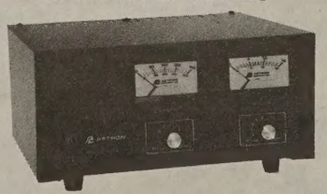
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

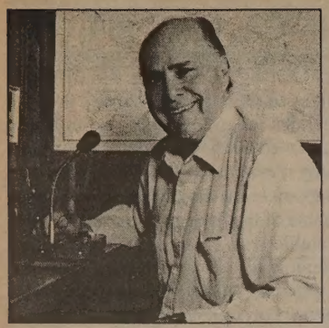
MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD



QLF

by Wayne Green W2NSD/1

"The Rig Here" . . .

If you suddenly found yourself in a contact with Barry Goldwater K7UGA, is this what you'd say? Or let's say you call King Hussein JY1 and he comes back to you. Is your next transmission going to be, "Roger, five-nine, over"?

Hussein has better things to do than exchange signal reports just so you can get a QSL card from Jordan. He gets on the air because this is one way he can talk to people as a person. Ditto Barry. So why are *you* on the air? To get a listing in the ARRL Honor Roll? Is that *it?* There must be some better things you can do in this life, like have a better bowling score you can brag about to the other angels, or as is more likely, devils—if such exist outside of our own minds.

Ham radio is a magical communications medium. Are you trashing the magic with trivia? When you end a contact, how much more do you know about the person you've contacted? What does he do? What other hobbies has he? What pets? What's the most fun he's had with ham radio? If he's traveled much, where's he visited? What books is he reading? Did he recommend some to you? Has he seen any really good movies lately? What's he like to watch on TV?

If you contact Barry, you already know a lot about him, so why not ask him if he has any ideas on what can be done to make Congress more honest so we don't have endless Rostenkowski-type situations? Or what he thinks is a good solution to the health care mess?

If you catch JY1, ask him how Jordan is doing. You might even press him by asking if he has any plans for getting Jordan's educational system out of the pits. Jordanian kids had the lowest marks of any country tested. Even worse than American kids. But we can be proud that American kids came in second from last.

What do I get asked when I make a contact? Well, first of all, probably one in 10 of the hams I contact actually recognize my call, so I start out on the same footing as you. Despite my spelling out my call, around one out of four get it wrong. If they continue to get it wrong after I've corrected them, I then start getting their call wrong. My that upsets them! Some get furious!

I must admit that I'm frustrating to contact. I don't volunteer what rig I'm using, or what antenna. I don't even go into great detail on the weather. No, for starters I ask them what they do. Then I ask what other bands they're on. I hunt around for something of mutual interest we can talk about.

What's Your Most Exciting Ham Experience?

I've been writing about my ham experiences for over 40 years now in my editorials. I've written about Operation World-Wide, where I flew around the world on an Air Force plane, operating 20m SSB the whole way, and visiting hams in 22 countries. And I've written about my DXpeditions. I've operated from over 60 countries so far, and every one of them provides interesting stories.

I want to know what you've done in amateur radio that's been exciting for you. I'll bet a bunch of *Radio Fun* readers would be interested too, so get cracking at a word processor and let's see what you've been doing. You might encourage other readers to try something new.

When I first got involved with RTTY I had a ball. It was fascinating learning about digital communications and building the equipment to make it happen. We even put up one of the first ham repeaters just so the RTTY nuts around New York could all contact each other on 2m. And that was back around 1950.

If you talk to any of the early sidebanders they'll tell you about the early sideband vs. AM wars. The AM old-timers didn't give up easily. But then neither did the old-time spark operators. "Spark Forever" was the cry!

So what happened when you first tried packet? Or maybe you've been having a ball on our ham satellites? If not, why not? And if so, how about telling us about it? Don't get me started on hidden transmitter hunts! No, I'd rather get you started. Sure, I talk about myself. I explain, perhaps not too convincingly, that this isn't ego, it's an effort to get you to break loose and write.

Did I tell you about the time I set up the JY73 repeater in Amman and got His Majesty active on 2m? Probably. Okay, did I tell you about when I was flying to Swaziland from Johannesburg and while I was talking over a ZS repeater from the plane suddenly I heard the Swaziland repeater and found myself also talking with the Swaziland hams?

You may not be able to top that, but you certainly must have some interesting stories to tell of your ham experiences. So tell them. I'll be interested to hear from you, and the readers will love it too. It might even help get them off dead center. RF

Newcomers

by Wayne Green W2NSD/1

This Is Your Last Copy

Well, maybe your next to the last copy, unless you are a paid subscriber. Two issues of *Radio Fun* are free—a sort of "welcome aboard" thing to newly licensed hams. If you are not yet a subscriber, I hope this will trigger you into subscribing, to both *Radio Fun* and *73*. This is a fun hobby with all kinds of interesting things to do and learn, but you need a monthly shot of excitement to keep you going.

For the price of a dinner in an average good restaurant ($30) you can get a year's worth of both publications. This will keep you up with what's going on and help you find out how to get in on the fun thousands of hams are having with the hobby, whether it be sending packet messages or going on a DXpedition to St. Pierre.

You'll also get a load of my editorials. Some people love 'em, and some hate 'em. Some hams will drive hundreds of miles to hear me give a talk at a hamfest. Others mutter unprintables and skip my stuff. My goal, both in publishing my magazines and writing my editorials, is to help you enjoy the things I'm enjoying, to educate, to open new worlds for you, to keep you from being a crummy couch potato, to get you thinking, and perhaps to help you be more successful in life.

The $30 price for both *Radio Fun* and *73* is to help get you hooked. You really should pay $39, the regular subscription price. Tell you what, if you find you're really looking forward to each issue, you can lift a tremendous load of guilt from your mind by sending me the extra $9. Or by ordering my ***Declare War*** book for $10 from Uncle Wayne's Bookshelf.

As a new ham I'm assuming that you are intelligent, interested in technology, and adventurous. This is the picture I have of you in my mind as I write my editorials and help Charlie Warrington WA1RZW, our Senior/Technical Editor, pick the articles for us to publish. Sure, we have some serious nut cases (mostly Extra Class hams, oddly enough), but 99% of my mail is from hams I wish I had the time to meet and make my friends.

You're going to enjoy the columnists I've rounded up to help you have more fun. And to learn more. No fair just rag-chewing and not learning. That's cheating. Cheating yourself most of all. It's fun learning how ham Teletype works. It's a ball building something and actually getting it to work! Wait'll you start getting some gorgeous pictures via Clover from Africa. You'll be driving your family and friends to distraction with more beautiful pictures every day from weird places around the world.

It's exciting to get a new piece of ham gear and get on the air with it, whether it's a 1-watt rig built into a matchbox, or a new kilowatt linear. My magazines run circles around the others when it comes to reviewing new equipment. Once you get to know what you are doing, I'd like to see what you can do in reviewing something you've bought. Both of my magazines are written almost 100% by the readers. Like you.

So send me a check for $30, or call in your credit card number, and let's make sure you won't miss an issue (603-924-0058). Most of the hams I entrap into subscribing keep right on for the rest of their lives. Well, what better amateur radio reference library can you have than a shelf full of *73*s? RF

Anyone (including you) can learn the Morse Code in one hour! Forget the No-Code License and get your Tech-Plus Ticket. Guarantee: You'll pass the 5 wpm code test with Uncle Wayne's system or YOU GET A 100% REFUND!

The truth is that no one using this new system has ever failed the 5 wpm code test. And it is highly unlikely that anyone ever will. We're talking about such a total no-brainer approach that many people are able to spend less than 15 minutes using this speed system before being able to ace the Novice-Technician code test.

Help your children, your wife and your friends get their ham licenses with this ultra-fast code system. Get your kids to help their friends to get their licenses. If we're going to try and keep our ham bands we need tens of thousands more hams. Millions will be even better.

Help start kids on their way toward high-tech careers by getting them hooked on hamming. The biggest obstacle to a ham license in the past has been the code. Now, with this new miracle system, this is just not even a minor problem. No longer will there be the slightest stress when taking that stupid code test that the ARRL Board of Directors has forced the FCC to continue to use as the primary method for keeping newcomers away from the hobby.

With the success of America in the next century dependent on our ability to provide high-tech career workers to deal with the information highway and the computerization of the workplace, amateur radio provides a fun way to ger kids interested in leaning about technology. It beats the heck out of Nintendo and Sega, which teach nothing. It even beats sports, which provide a good living for a handful of stars and disappointment and poverty for the losers.

We need to see radio clubs sprouting in our secondary and high schools again. We need to see hamming become a major activity in retirement homes and villages. We have room for millions of hams on our bands...of which we're using less than 0.2% today on any regular basis. Yep, that's right, 99.8% of our ham bands are just sitting there almost totally unused, with us waiting around for the FCC to sell them off and pocket the money without even a word of thanks.

How much are we charging for Uncle Wayne's One Hour Guaranteed Miracle Code Course? $5.00 postpaid. That's right, it's only five bucks! Since our charge card minimum is $7.50, maybe you should order some of Uncle Wayne's exciting adventure stories as advertised by Uncle Wayne's Bookshelf. Or send $5.00 cash or check. This will be one of the better five bucks you'll ever spend. $50 a dozen, if you like to spread joy.

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Tuned LC Oscillators

by Robert C. Green W3RZD

Five years after his invention of the triode vacuum tube, Lee De Forest in 1912 discovered a means of improving the selectivity and sensitivity of radio receivers. He called his discovery *regeneration*. Since its discovery regeneration has become a very important factor in electronics. Perhaps its most important role is in the development of the VFO, or Variable Frequency Oscillator, used in transmitters, receivers and test equipment.

Feedback and Polarity

Basically, regeneration is feedback. That is, a portion of the output of a circuit is fed back to the input to reinforce the signal. When the regeneration is of the correct magnitude and phase, oscillation will result. Because audio and radio frequencies are alternating currents each cycle of the signal has a negative and positive half, which means that at any instant they have a certain polarity. For oscillation to take place the signals must be "in phase," meaning that the returned signal has to be of the same polarity as the incoming signal. If the feedback is out of phase it is said to be *degenerative*, or negative feedback. Negative feedback will not increase the gain of a circuit but will reduce distortion and improve stability.

In a typical vacuum tube circuit, and in some transistor circuits, the original signal will be reversed in polarity by 180 degrees as it passes through the circuit. When this happens the portion of the output that is fed back to the input will be out of phase. To correct for the reversal another stage of the same design will have to be added and the returned output taken from it.

Regeneration can also be unwanted. One form of unwanted audio regeneration will occur if the microphone of a public address system picks up some of the output and feeds it back into the amplifier. The result is an uncontrolled squeal in the loudspeakers over a wide band of audio frequencies, thus turning the amplifier into an audio frequency oscillator. Actually, in this case the regeneration is caused by external sound, not by an internal electrical signal, but the effect is the same. When the microphone is moved to another location or the microphone gain control is reduced, the squeal stops. By reducing the gain the amount of regeneration is controlled.

This example shows that an amplifier, audio or radio frequency, when the proper conditions exist, can become an oscillator. However, the amount of regeneration must be controlled if the oscillator is to be useful. The amount of feedback needed for oscillation is given as: The percentage of attenuation in the feedback circuit multiplied by the gain in the amplifier must equal 1 or greater. So if the attenuation factor of the feedback voltage is 0.2, the gain of the amplifier must be 5 or greater. There will always be some attenuation in a feedback circuit.

Frequency

The frequency of the feedback signal also has to be controlled and this is done with a filter network. See Figure 1. The filter for RF circuits is in the form of an LC (inductor capacitor) network. LC circuits can be used as low as 15 kHz, but circuit components are large and there will be instability.

When the feedback filter is a series LC circuit the frequency to which it is tuned is accepted and other frequencies rejected. If the filter is a parallel LC circuit the tuned frequency is rejected, with the unwanted frequencies bypassed to ground. Hence, the filter should be a parallel LC circuit. One easy way to remember the difference between series and parallel circuits is to think of the parallel tuned circuit in the front end of a receiver. Here the rejected or tuned signal is the one that is amplified and detected, and the unwanted frequencies are shunted to ground. The tuned filters are shown in Figures 2 and 3.

Although LC oscillators are normally used as VFOs, they can be of a fixed frequency. This can be done by substituting fixed value capacitors for the variable capacitor. However, it's better and easier if a variable capacitor is used and its shaft locked mechanically at the frequency desired. Of the many types of VFOs the Hartley and Colpitts are the most popular, and the circuits for these are shown in Figure 4. There are variations of both types that carry different names. Any of the circuits can be used in either solid-state or tube form.

Controlling Feedback

As was mentioned previously, the amount of regeneration in an oscillator has to be controlled so that only a portion of the feedback is returned to the input. This is done in the Hartley oscillator by applying the feedback voltage to a tap on the coil, and through mutual inductance a portion of the voltage is fed into the larger section of the coil. However, the entire coil is part of the tuned circuit. The tap is placed between 15% and 25% of the total winding from the ground end. The tap placement is dependent on the gain of the tube or transistor—the lower the gain the higher the tap from ground.

The feedback voltage in a Colpitts oscillator is controlled by applying it to a tap between two fixed capacitors in the LC circuit. The two capacitors are usually of the same value, but not always. If there is a difference in capacity it will be determined by the gain in the tube or transistor, but the total capacity of the two capacitors must still resonate the coil to the desired frequency. Due to the reactance (AC resistance) of the capacitors, part of the feedback is shunted to ground and part is fed into the circuit.

The Colpitts oscillator shown in Figure 4 has a variable capacitor in series with the coil. This looks like a contradiction to what was said about needing a parallel LC circuit, but a closer look will show that the series LC is actually in parallel with the tapped feedback capacitors. The purpose of the series capacitor is to afford a means of tuning the circuit. Both the Hartley and Colpitts are stable oscillators at the lower frequencies, but for operation at the higher frequencies the Hartley has better stability.

Bias

All types of oscillators and amplifiers require a bias voltage. Bias is a DC voltage applied to the control element of a tube or transistor that sets a reference level around which the AC input signal operates. There are three classes of bias: Class-A, Class-B and Class-C. Class-A can be defined as when the output current of the amplifying device flows through 360 degrees of the input voltage cycle. In Class-B operation the output current flows for only 180 degrees of the input voltage, or one-half of an input cycle. With Class-C operation the output current flows for less than one-half of an input cycle. For the output signal to have the same characteristics as the input signal, Class-A bias is used. Class-A is used in oscillators and some RF amplifiers. Audio amplifiers can be operated either Class-A or Class-B, while Class-C is used only in RF power amplifiers.

Temperature Stability

For any oscillator to be useful it must have a stable frequency. Stability is mainly dependent upon the type of construction and the quality of the parts used. It is important that internal heating be kept at a minimum. Regardless of what type of circuit is used, remember that the coil/capacitor combination will be affected by the location of other parts and nearby metallic objects, so consideration must be given to the circuit layout.

The value of the fixed capacitors must also remain stable with changes in temperature. Small ceramic disc types should not be used as their capacity changes considerably with temperature. Polystyrene capacitors are much better. They have very little change with temperature, and their manufacturing tolerances are small. Silver mica capacitors are very good if temperature-stable ones can be found. Some silver micas will show an increase in capacity and others a decrease as the temperature rises. If these capacitors are to be used each one should be heat-checked for change for a period of several hours. This can be done by connecting the capacitor to a capacitor checker and blowing warm, not hot, air from a hair dryer across it, but don't let the warm air strike the capacitor checker. This requires checking quite a lot of capacitors before a few stable ones are found.

Construction

The variable capacitor should be of double-bearing construction, meaning that each end of the movable rotor should be supported by ball bearings. Preferably, this capacitor should have four feet to ensure solid mounting. The plates of the average variable capacitor are made of aluminum, which expands with heat and can cause a change in capacity. Variable capacitors with brass-plated or solid-brass plates are available and should be considered; however, their price is very high.

The coil should be air-wound using large-diameter solid wire to keep down expansion. If the coil has to be wound on a form it should be of hollow ceramic or steatite. A form that has a metallic core, such as powdered iron or solid brass, should be avoided as the core will expand with heat and change the inductance. The coil should be mounted at least one coil diameter from other parts that could affect the inductance. In all cases the coil should be painted with several coats of a good quality coil dope to hold the turns in place.

When the VFO is to cover several bands of frequencies the Hartley circuit should be considered in place of the Colpitts as only one tuning capacitor is needed. However, the additional frequency bands require additional coils, so a band-changing switch for the coils is necessary. The switch should be made of ceramic or steatite for rigidity and low RF loss. Never use plug-in coils. Plug-in coils require entry to the VFO which can result in damage, such as movement of wires or parts, or damage to the coils as they are handled. Another point to consider is that each plug-in coil will be of a different size (smaller for the higher bands), making it difficult to have a common mounting base.

The major rule in the construction of any variable or fixed frequency oscillator is *rigidity*. There shouldn't be any flexing or twisting of the chassis or any component. If the oscillator is to be portable, such as a signal generator, the rule of rigidity also applies to the cabinet housing the unit. Any flexing of the chassis or cabinet can cause a change in the output frequency, so the cabinet should be made of metal, preferably steel.

A metal chassis is preferred to PC board construction, and a steel chassis is preferred to an aluminum chassis. Size-for-size, steel will not twist and flex as will aluminum. To

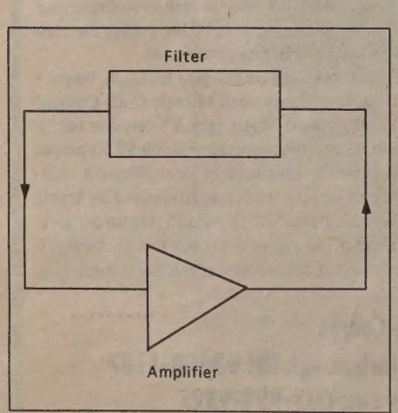

Figure 1. Feedback circuit.

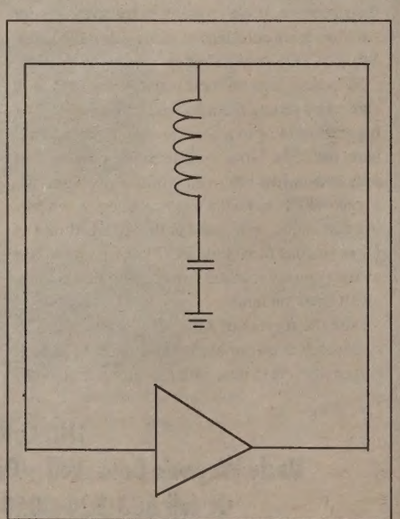

Figure 2. Series LC circuit.

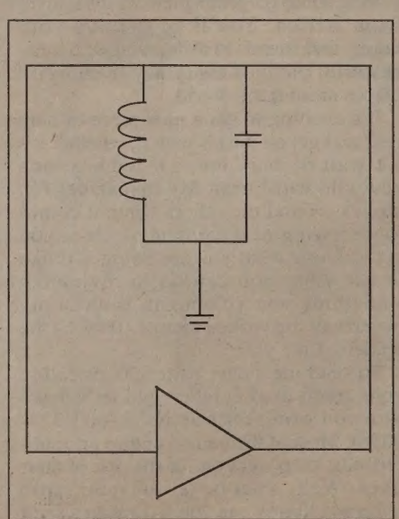

Figure 3. Parallel LC circuit.

Continued on page 6

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letters

Write to: Radio Fun Letters
70 Route 202-N,
Peterborough, NH 03458

Charlie Smith KE4OZN, Chattanooga TN Wayne, I agree with your opinion of the code. I am a new Tech Class ham and am planning on upgrading ASAP. However, I see no need to prove myself over and over again. Theory is fine but code speed is outdated.

I am interested in just about *everything* on this new hobby but know that it'll take time—and *money*—to explore . . . That's what it is about!

Right now I'm trying to get as many family members as I can interested in radio. It's tough, but I'm *gonna* do it!

In closing I simply want to say how great this hobby really is. We need to let others know.

E.F. "Tex" Heintzelman N7ULU, Phoenix AZ I look forward to *Radio Fun* and *73* each month. I am an old man but the richest in the world with friends in ham radio. I was interested in ham radio for a long time, then in 1989 I made up my mind to get my ticket in 1991. I had an HF rig and a 2 meter rig. I got my Tech-Plus and in about a year I got my General. Last September I aced my Advanced. Now I am studying for my Extra. I read all the articles of importance to me to better myself and to help all mankind. I am 68 years old and 100% disabled, but my mouth and brain still work. I like public service. I belong to four clubs to keep busy.

If I find an article very interesting I put it on cassette.

Wayne, I really like the way you put your point across. Keep up the good work!

Rich Ballieu WBØTML, Sioux Falls SD Wayne, I read your November 1994 "QLF" column about Technician and Tech-Plus licenses being grandfathered to General. Sure, code is fun. But maybe there are Techs who just want to stay that way. I have a friend who has been a Technician for a number of years and he enjoys it. He operates 2 meters and 6 meters.

I was a Technician Class licensee from 1982 to 1991, then in 1991 I got my General Class license. Sure, I was working on Morse code, but I was having a difficult time with it until one day a ham came to Rapid City, South Dakota, from Florida to get his RV worked on and we talked a little bit. He encouraged me to take the 13 wpm code test. A friend of mine in Rapid City also encouraged me to take the test, and we both took it.

Here are the two ingredients you need in anything you do in life: Number one is attitude; number two is that a person needs a challenge. Needless to say, we both got our General Class licenses. I didn't want to be considered a Tech or Tech-Plus anymore.

In June 1994 I got my Advanced. Why? Because it's the next step higher from General, has more frequencies on HF, and more modes (even though I use CW or SSB). I had a challenge and encouragement from my wife. I failed the test the first time, but in in June I had the right study material and my wife helped me on it. So that Saturday morning it took me 15 minutes to do the written part and I passed it with a 100% score.

Then in September 1994 I took my GROL commercial radio exam in Sioux Falls, South Dakota, by the ISCET group in Texas, which has a testing site here in town. I took the test, and 14 days later I got my Proof of Passing certificate. Then, on November 25, 1994, I got my lifetime GROL license.

Two licenses in one year, not bad at all! But to get back to the subject, Morse code is not being phased out. Read *Morse Code: The Essential Language* from the ARRL. I did. It'll help you on upgrading or change your way of thinking about CW. CW is not dead by any means. Like anything else in life, "Use it or lose it."

If a person wants to stay Tech or Tech-Plus, that's fine; or General, for that matter—that's fine, too. I don't want Extra. I don't care to do 20 wpm; 13 wpm is sufficient for me. As for the theory, leave it to a physics or math instructor. I've got my commercial license, and that's good enough for me. My wife has helped me out, and my attitude and job situation have gotten better. It's all up to the individual. It has been a good year.

John Byrne WB6VFT, Quartz Hill CA I have just subscribed to *Radio Fun* and have a suggestion. Like some amateurs, I am intimidated by the numerous buttons, switches and combinations of functions on the 2 meter rigs. I currently own an Alinco 110T/E and I may not be operating it properly. To help me and others who own technically sophisticated radios you might, through your magazine, explain the function of the "Reverse" key, "Shift" key, encoder, "Function" key, etc., on such radios as Kenwood, Alinco, Icom, Yaesu, etc.

Kenton Larson KBØMEO, Loveland CO I just got your sample issue of *Radio Fun* and I really like it. I have been trying to get a used radio from a friend. I have just now purchased it, with a power supply and a J-pole. I really like your construction articles because they are simple and look like they are very useful. Your product reviews are easy to understand and well-written. I am concerned about the shortage of good used parts, and the price of new ham gear.

Douglas E. Stangler AB7BU, Renton WA I have only been a ham since 1993, but after reading all the controversy about eliminating the code as a requirement, I have formed my own opinion about the situation. I believe that the code should be eliminated because it just isn't an important means of communications anymore. Those who want to learn the code would always be free to pursue that aspect of the hobby on their own. On the other hand, I do not think it should be made any easier to achieve the different levels of license classes. I propose that if code were eliminated, or the speed requirement reduced, the written portion be made *much more* difficult. This means that the FCC must stop giving away the answers and that the tests be structured in such a way that knowledge of electronic theory must be demonstrated, rather than answers being memorized. I think this change would satisfy those who want people to have to *earn* their privileges. I was one who hated to study the code (and have never used it) and would much rather have spent the time on *learning* the theory.

Ken Porter, Walkersville MD As of November 12, 1994, I'm a new amateur radio operator. I obtained my Technician Class license, and as soon as I receive my new license from the FCC I'll have my call letters! I'm already working on my General Class license and hope to take the test in February, the next time the VEC will be in my area.

I have already put together two kits, one a 6 meter receiver from Ramsey Electronics, and the other a 1 watt, 80 meter CW transmitter from 624 Kits. I thought that doing VHF and above, plus HF kits, would be most interesting. RF

AMSAT Phase 3-D Under Construction and On Schedule for April 1996 Launch!

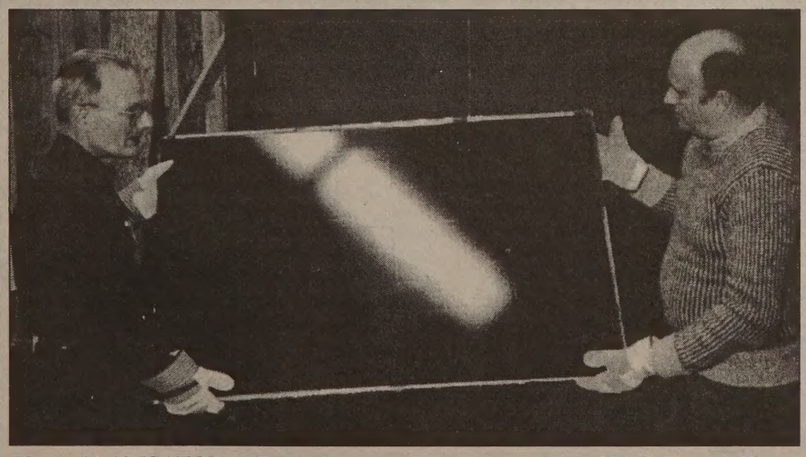


Photo A. AMSAT-NA V.P. Engineering Dick Jansson WD4FAB (L) and Executive V.P. Keith Baker KB1SF (R) inspect one of the flight model solar panels for amateur radio's newest and most advanced satellite. Working at the P3-D Lab at Weber State University in Ogden, Utah, the men display the Kapton electrical insulation layer. These panels, valued at more than $50,000, were donated to the project. ***(Photo by Ralph Butler, Weber State University.)***

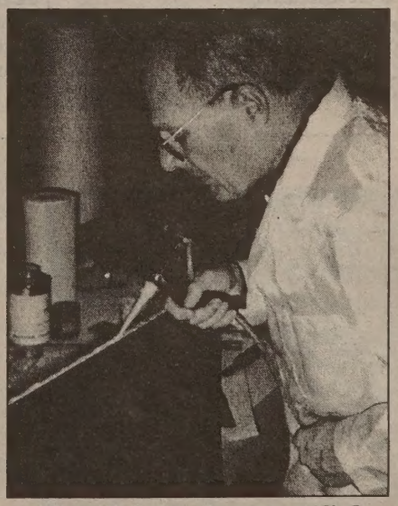


Photo B. Later, Jansson applied epoxy resin to the edge of one of the panels, which are constructed of 1/2" thick aluminum honeycomb material covered by a thin carbon composite facesheet. Each panel weighs only a few kilograms.
(Photo by Keith Baker KB1SF.)

Full-Wave Loop Antenna for 2m

by J. Frank Brumbaugh KB4ZGC

Here is an ideal "quick and dirty" antenna for the traveling ham. It can be rolled up, carried in your pocket, then taped or thumb-tacked to a hotel or motel room wall. It also can be easily erected in the woods while camping, or anywhere communication is needed in a hurry. It is a broadband antenna and provides a much wider range than the usual rubber ducky.

Illustrated in Figure 1, the antenna consists of 82 inches (208 cm) of insulated wire fed by two multiples of electrical half-waves of 50 or 75 ohm coax.

The measurements shown are very important to ensure an SWR of less than 1.5:1, and were determined empirically.

Full-wave loops for HF are usually set up to enclose the greatest area—a circle or a square. On 2 meters, both circular and square configurations resulted in an SWR of 10:1 or higher.

I next tried a symmetrical delta loop with all sides equal in length. The SWR was 9:1, suggesting that a delta loop of some shape might provide a usable antenna.

The dimensions given in Figure 1 are the result of a number of experiments with various triangular configurations. Not possessing test equipment to enable measurement of impedance at the feed point, I prepared a length of RG-59 with an electrical length of two wavelengths. The measured cable length, including connectors, is 61 inches (155 cm). Using an integral number of half-wavelengths of coax ensured that my handheld would "see" the impedance of the antenna as if it were directly connected to the feed point of the antenna.

As a check to determine if the use of RG-59 coax was important, I replaced the RG-59 with a piece of RG-58 (52 ohm impedance) 8 inches long. In both cases the SWR was less than 1.5:1. Regardless of the 75 ohm impedance of RG-59, the impedance at the end of an integral number of half-wavelengths is the same as at the other antenna end.

It would seem that this antenna configuration could easily be incorporated as the driven element in a two- or three-element beam. Also, it could also be translated to 222 MHz or 70 cm bands. Possibly delta loops for all three bands could be mounted in the same plane and share the same feed point.

I do not have equipment for 222 or 70 cm, nor test equipment. Experiments with this antenna configuration will have to be made by well-equipped VHF/UHF hams. RF

Note: Antennas West (1500 N. 150 W., Provo, UT 84604; 801-373-8425, Fax 801-375-4664) provides both a kit and a nicely-finished, ready-to-use version of the loop. The kit ($5.00 ppd.) includes plans, loop wire and connector. The ready-to-use version is called the PicoLoop(TM). The PicoLoop is fully assembled, totally insulated, amd complete with its own RF isolated 7-foot feedline and gold pin BNC connector. The PicoLoop is shipped with a glasses-size pocket pouch, and three transparent suction cups for quick installation on any window. The price is $19.95 ppd.

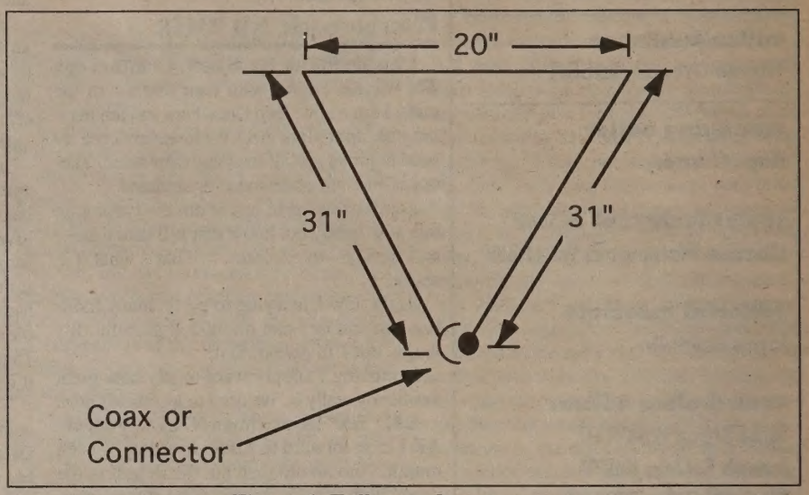


Figure 1. Full-wave loop antenna.

Tuned LC Oscillators

Continued from page 4

further minimize twisting, the chassis should be of heavy-gauge metal, and have four sides which are welded at the corners. Whether the oscillator is mounted in a cabinet or built into a transmitter, the chassis should have a steel bottom plate.

When or if a PC board is used, it must be plated on one side only. If a double-sided board is used, the plating on the unused side will act as a capacitor and affect the tuning capacitor or the coil. The board should have a glass epoxy base as it is more rugged than a fiber base and less susceptible to flexing. The copper traces should be separated as much as possible, and all surplus plating removed. Also, the board should be supported at as many points as possible to prevent flexing.

If a transformer-type power supply is to be incorporated in the design, the chassis should be large enough that the supply can be mounted at one end and the RF section at the other end. Radio frequency chokes and harsh filter chokes should be installed in each lead of the power cord. This will prevent RF escaping from the enclosure on the power cord, and also prevent unwanted electrical noise, which could possibly modulate the RF signal, from entering. Along with this a shield made of steel should be placed between the RF section and the power supply to prevent 60 hertz hum from the transformer modulating the RF signal. A well-regulated output from the power supply is also a necessity.

Bus bar is a type of wiring that has been in existence since the early days of radio, and is still in use today where circuit stability is required. Bus bar is uninsulated, tinned, solid wire, usually about #16 in size. Due to the size of the wire it can be formed into rigid leads between components. Because of the rigidity of the bus bar it should be used for all connections to the frequency-determining parts, including the band switch. Each end of the bus bar should be mechanically secure before it is soldered.

It is good practice to feed the output of the VFO into a buffer (isolation) amplifier. This will prevent other circuits which follow from loading down the oscillator and pulling it off frequency.

Before any VFO can be really useful there has to be a means of knowing the frequency. A large dial with a long pointer over a calibrated scale is ideal. If the scale is marked in arbitrary numbers, such as 0 to 100, it means that each time the frequency is changed it will be necessary to guess or else refer to a previously calibrated chart. Operation is easier if the dial scale is marked with the actual frequency. The VFO dial can be checked against a receiver that has a digital readout, or by using a frequency counter. If the dial has a reduction gear or if the tuning capacitor's shaft has a reduction gear, it will make for a VFO that can be set "right on the button." The reduction drive should be a gear-to-gear arrangement, not a friction drive, and the gears should mesh snugly to prevent an inaccurate reading. Along with this the capacitor shaft must be in alignment with the dial and not bind against the panel.

This article is intended to give you an insight into the fundamentals of LC oscillators and their construction. For details on the size of coils and capacitors for use on the amateur bands refer to one of the many amateur handbooks available. If you decide to construct an oscillator, remember that time is *not* of the essence. Taking your time in construction will pay off—you will end up with a piece of equipment that will be stable and will give years of satisfactory service.

Referring back to the opening paragraph: Some readers will say that Edwin Armstrong invented or discovered regeneration. This is true, but that was in 1914. Both De Forest and Armstrong worked on the principle independently, with De Forest developing the idea in 1912. However, De Forest did not patent his discovery. It took two more years before Armstrong found the answer, and he did file for a patent, which was granted. After a court battle, Armstrong's patent was revoked and awarded to De Forest. RF

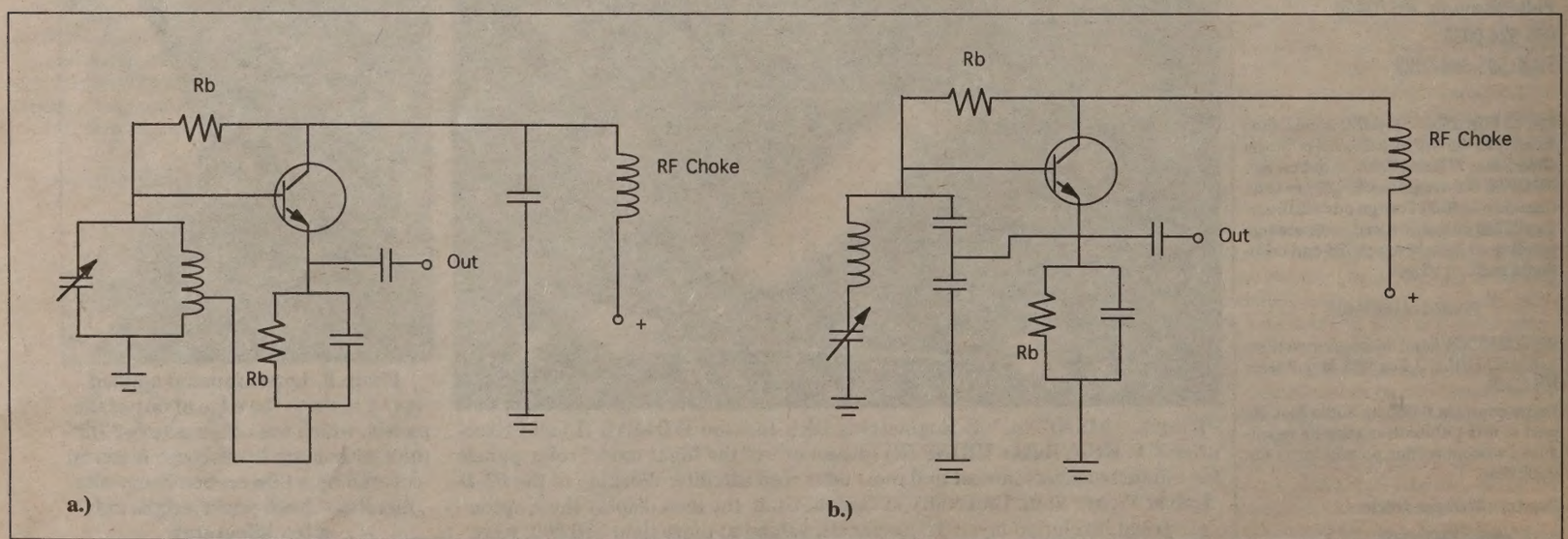


Figure 4. a) Hartley oscillator; b) Colpitts oscillator. The Rbs are bias-setting resistors.

Getting Started in Hamming

by John S. Szwarc N3SPW

Do you remember your first contact? Mine was on August 30, 1994. With a borrowed 5/8-wave mag-mount antenna my new 2 meter station was on the air. Jim N3ONE has the honor of being my first ham radio contact.

Looking back at everything involved in getting my new ham radio license, I found myself wondering if all modern-day hams have the same experiences and difficulties getting started. Sure, it may not be as difficult as the old days. The old-timers love to reminisce, telling stories of how they built their first radio from a tin can and a few resistors they just happened to have lying around. They tell me "real hams don't use anything less than CW to communicate."

Well, OK. Things may not be as primitive as they were 50 years ago. Today new rigs are commonly available, eliminating the need to raid the kitchen for spare tin cans. And every now and then I hear one of those "real hams" on the local 2 meter repeater—and they're not using CW!

So you don't have to learn the code to get started anymore. Getting your ticket is still a challenge! That written test is still much the same written test it was years ago. Sure, the wording of questions may have changed, but the basic material is still the same.

My Story

My involvement in ham radio dates back to my high school days. A friend of mine invited me to attend a Field Day operation set up at a local park. That was all it took; I was hooked! We stayed overnight working the airwaves into the wee hours of the morning! The entire operation was housed in a motor home and a carnival-type tent, powered by portable electric generators.

That Field Day was when I made an amazing discovery: Ham radio operators don't have last names, they have calls! Afterwards, Chris KA3HOW encouraged me to sign up for a Novice licensing class. Sure, sounds like a good idea. I had fun at the Field Day and Chris said passing the code test wasn't all that difficult. My dad gave me an old straight key he bought years ago and encouraged me to learn CW. Studying for the theory seemed easy enough. Then we started working on the code. I remember thinking that this has got to be the most difficult thing ever invented! How could anyone ever learn to recognize all the characters? Learning CW seemed so overwhelming to me. It wasn't long before I dropped out, convinced I would never pass the five-words-per-minute code test.

The years passed and my Novice study book collected dust in my bookcase, a constant reminder of what I had set out to do. After college, starting a career, and marriage, time for ham radio seemed to be in short supply.

My Local Club—the Philipsburg Amateur Radio Association

Finally, I decided to track down a local ham club in my new hometown. I found one, the Philipsburg (PA) Amateur Radio Association. This is truly a unique group. Nothing like I had expected. There is no president, no vice president, and *no* agenda or committees to report back to the membership on special projects. About the only structure to this whole organization is the regularly scheduled meetings each month. It's more of a social gathering for the area hams!

Dave AA3EJ encouraged me to begin studying for the no-code Technician test. With only a couple weeks of studying under my belt it was time to take the test. I wasn't quite sure what to expect as I sat down to the test. I hadn't taken a test in years! After I got started, all the information I'd studied seemed to flow and I passed the test! What a feeling of relief and excitement!

Our testing session was followed by a club meeting. The topic of conversation for the evening was selecting equipment for the new 2 meter repeater, now in the planning stages. What a "hands-on" conversation for a brand-new ham to get involved in! Of course I asked my share of questions. After being a ham for only a matter of minutes, I didn't know the first thing about how to put together a repeater! Everyone was very accommodating and explained exactly how a repeater works and what equipment is required.

My First Ham Shack

So now I've passed the test! Hmm, time to start thinking about equipment. Some other hams told me about the mail-order outlets, so I thought I'd request a few catalogs. I'd seen several outlets advertised in the ham magazines and they sounded like reputable companies.

"Hello, ABC Electronics," the operator said.

"Yes, I'd like to request a catalog."

"Sure, I'll need your name, address, and call."

Call? But I don't have one yet! The operator assured me he would send out a catalog anyway. The weeks passed, and still no catalog! Do you have to be a license-carrying ham just to get a catalog? Apparently this is the case with some mail-order firms.

Fortunately, some nearby hams had a spare catalog to get me started. Several local hams showed me their shacks and gave equipment recommendations. I found myself asking questions like "Exactly how did you get your wife to agree to that tower in the back yard?". After spending several days pouring over the mail-order catalogs and talking with other hams, I had decided on the shipping list. With my mind made up on equipment, all I needed now was a call!

> ***"Be warned: Visiting other hams and watching them work CW with a station from somewhere like Europe can be contagious!"***

Delays, Delays

It's been weeks since I passed the test and still no ticket in the mailbox! They tell me the FCC is installing some new computer system which is causing all the delays. That doesn't matter to me, though. I want my license so I can get on the air! After about eight weeks it finally arrived!

Now let's get that order in for the equipment. My new 2 meter rig, power supply, and antenna arrived several days later, just as my wife and I were packing for a weekend vacation. What was I to do? Cancel the trip? My wife would never agree to that! I did the only thing I could; grabbing the owner's manual from the radio box, I stuffed it into our luggage! At least this way I could study up on my new radio. My wife, however, wasn't quite as enthusiastic as I was about this new hobby. "I can't believe you brought that with you! Couldn't you wait until we got back?" Oh well, so much for what seemed like a good idea at the time.

The Big Day—On The Air at Last

After returning from our weekend trip I finally had a chance to unpack the new equipment and see what it was all about! A fellow ham, Jim N3ONE, stopped by to help put it all together and get my new shack on the air. He brought a 5/8-wave mag-mount antenna to get me on the air until we could gather everything necessary to assemble the Ringo Ranger II on the roof.

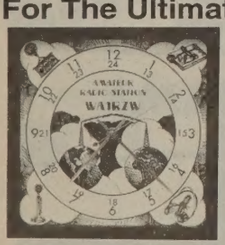
At last! On the air! "N3ONE, N3ONE, this is N3SPW." Jim came back and it wasn't long before other hams got involved in the conversation. What a feeling of accomplishment!

Where Do We Go From Here?

It seems the grass is greener on the HF bands! Be warned: Visiting other hams and watching them work CW with a station from somewhere like Europe can be contagious! When I got involved in this hobby, I never thought I'd want to upgrade. Right now I find myself in the middle of studying for the 13-words-per-minute code test and the General Class theory. Yes, the code is still difficult for me, but working at my own pace, I've gotten further along than I ever did with that Novice Class years ago!

My local club is still working on getting the new 2 meter repeater on the air. Through some friends of mine I've managed to get donations, including a pair of radios. With the RF end of the machine in place, all that remains is a duplexer, controller, and antenna. Wow! I have learned a lot about ham radio and repeaters just from getting involved in my local radio club. RF

For The Ultimate Shack!



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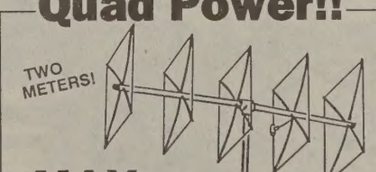

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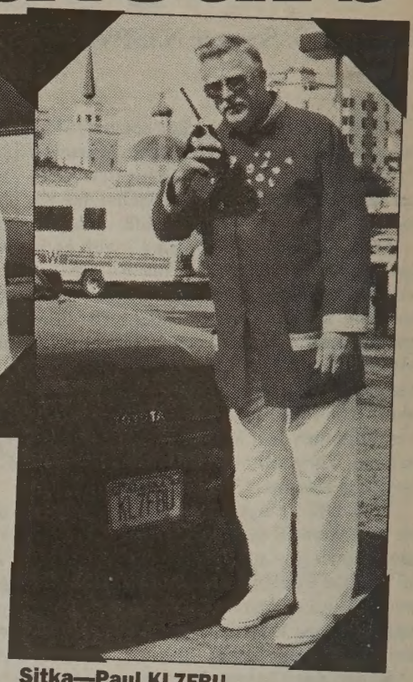

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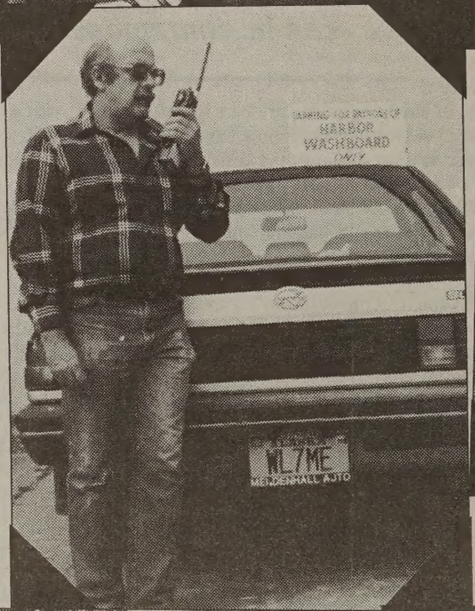

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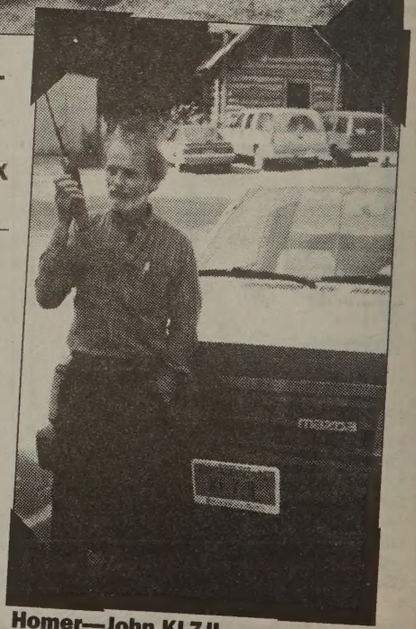

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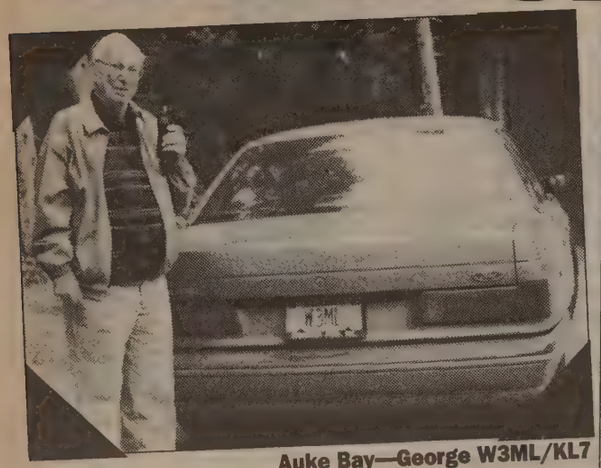

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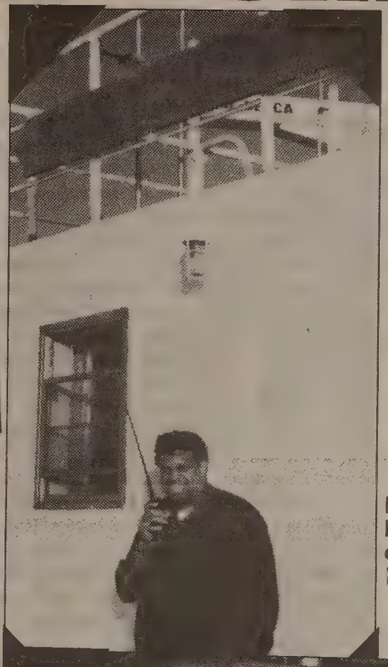

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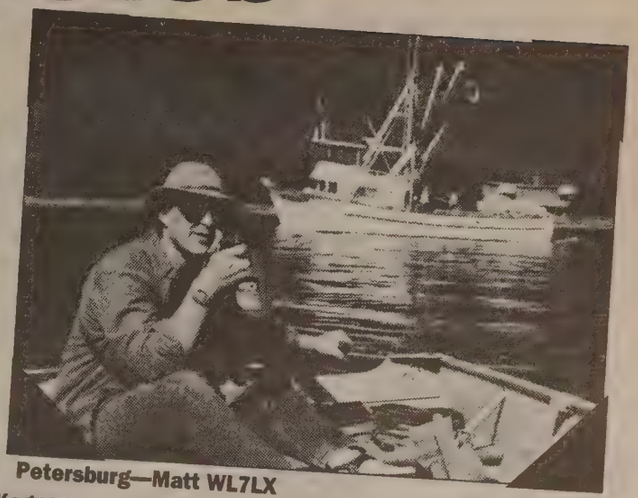

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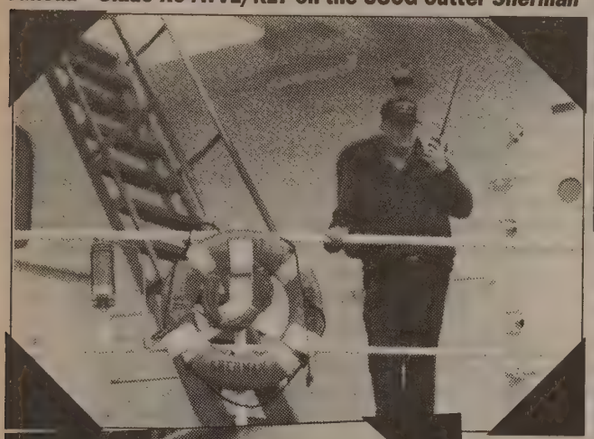

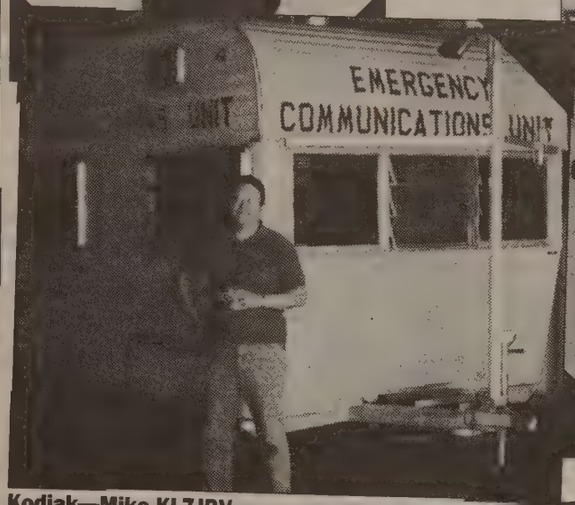

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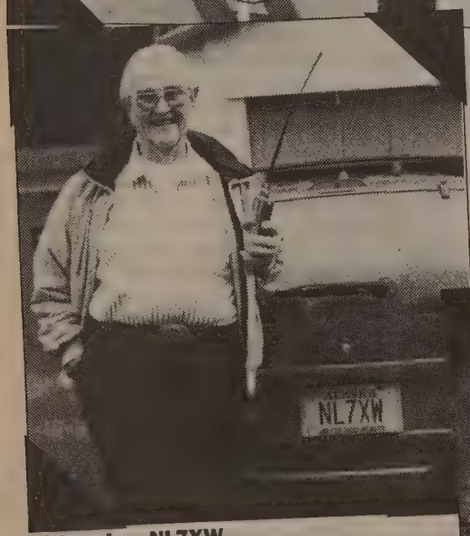
Anchorage—Simon NL7VR



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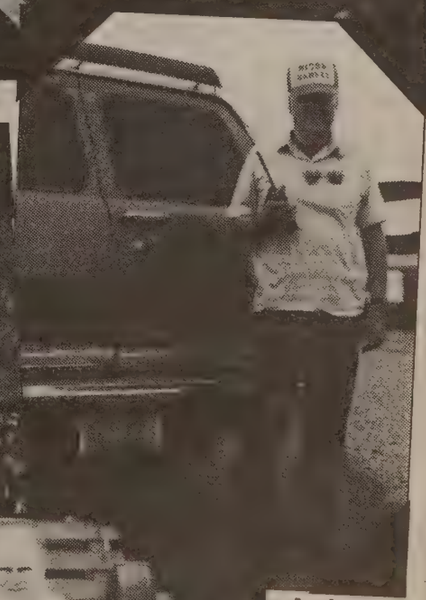

Kodiak—Brian WL7RJ

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Rick N6IV/KL7

George toured Alaska for over 29 days in 1994, including nine scheduled flights, one train ride, three buses, six ferryboats and numerous auto trips.

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Power Transformer Primer, Part 1

by Robert C. Green W3RZD

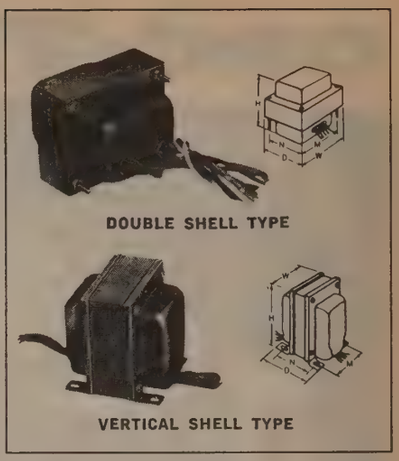

Photo A. Double-shell (top) and vertical-shell (bottom) type transformers.

It is amazing how many electronic experimenters and radio amateurs don't know how some of the electronic parts they use function or the theory behind them. One such item is the power transformer, a part that's used in a wide variety of applications. Before we take a transformer apart to see what's inside, let's review some of the things we do know about them.

A transformer is a device with no moving parts, that will transfer an alternating voltage from one electrical circuit to another circuit. The voltage transferred can be of the same value, or it can be transferred to a higher or lower value. Physically, a power transformer is two or more coils of wire wrapped around a metallic core. One coil is designated as the primary, and the other coil or coils as the secondary. The incoming voltage is connected to the primary and the output voltage is taken from the secondary. If there is more than one secondary they do not have to be identical; each can have a different voltage and current rating. A conventional transformer does not have a direct electrical connection between any of the coils; however, there is one type of transformer that does and it will be decribed further on.

Electrically, a transformer works on the same principle as a generator. In a generator, when a magnetic field or flux cuts across a conductor a voltage is built up in the conductor. With a transformer, when a voltage is applied to the primary a flux develops which passes into the secondary, and as the flux cuts across the winding it develops a small voltage in each turn of wire. The output voltage is the sum of the voltage in each turn of wire.

The Core

The core of any power transformer should be made of high-grade, laminated silicon steel, with every lamination dipped in shellac or varnish. The better grade of core metal is referred to as "transformer iron." If a core is made of stovepipe or other poor quality iron a transformer will only be able to supply about 50% of its capable wattage.

Power transformers normally have an efficiency of 95% to 98%, although a poorly designed unit can have an efficiency as low as 60%. Poor design results from using undersized wire, or an undersized core, and/or the wrong type of core material.

There are two common shapes of cores: one in the form of a square or rectangle with an opening in the center; the other core in the shape of a square-sided figure eight. See Figures 1a and 1b. To facilitate the winding of the coils, both types of cores are made in two sections: one section in the form of strips and the other in a square "U" or "E" shape, depending on the style of the core. When the core is assembled after the coils have been wound on it, the strips are placed next to the open side to make a continuous or enclosed form. Each lamination is alternately stacked so the single pieces are at opposite ends.

A core in the form of a square or rectangle has the coils wound on two separate but opposite legs. A core in the form of a figure eight has the coils wound on the center leg, normally with one coil wound on top of the other coil. A square or rectangular core will not have the efficiency of a figure-eight core, and also will have poor regulation of output voltage. This type of construction is used when one winding has a very high voltage, or when it is necessary to reduce capacitive coupling between the coils. A transformer of this type has "core-type" construction, as shown in Figure 1a. The figure-eight core is called a "shell-type" transformer, and is shown in Figure 1b.

Power

Every transformer has a wattage rating. This is the amount of power that normally can be drawn from the secondary without causing losses and overheating. If there is more than one secondary the total wattage rating is the sum of the wattages of all secondaries. The wattage of each secondary is found by multiplying the designed output voltage by the designed output current. Other factors that determine the wattage rating are the cross-sectional area of the core, core material, and the diameter of wire on the coils.

The wattage rating of a transformer is definitely dependent on its core size. Transformer design engineers have compiled many charts of this relationship and copies can be found in electrical engineering textbooks and in some amateur radio manuals. To use the charts, let's assume we want a transformer that has a secondary winding that will supply 25 volts at 6 amperes. The wattage is 25 x 6 = 150. Referring to the textbook charts, the leg of the core around which the coils are to be wound should have a cross section of 2-1/4 square inches. If there is to be more than one secondary, the wattage of each would be added to determine the necessary core size. So if there is another secondary of 25 volts at 6 amperes it would also have a rating of 150 watts, and the total wattage rating for both secondaries is 300 watts. Checking the charts, we find that the cross section needed has now increased to 3-1/8 square inches. The number of square inches is the height times width of the leg on which the winding is to be placed.

Staying with our imaginary transformer, if 150 watts can be drawn from the secondary then the primary has to be capable of supplying 150 watts. We know the power line is capable of 150 watts, but: Can the primary carry 150 watts? Disregarding the slight losses present, the current flowing in the primary is found by dividing 150 watts by the voltage to which the primary is connected. In this country the line voltage is normally 120 volts, so if we divide 150 watts by 120 volts we get 1.25 amperes. Now we know that our transformer will need a secondary wound with wire that will carry 6 amperes and the wire on the primary will have to carry 1.25 amperes. Hence, the wire on the primary can be of a smaller diameter. Remember that the wattages on both sides of a transformer are the same, and you can't get more out of a transformer than what is put in.

Number of Turns

The voltage on any secondary is determined by a ratio of the number of turns of wire on the secondary to the number of turns on the primary. Hence, when designing a transformer one of the first steps is to determine the number of turns needed on the primary. The turns needed depends on several factors: the frequency of the input voltage, the core material, the wattage to be drawn, the cross-sectional core area in square inches, and the amount of magnetic flux per square inch in the core.

When a transformer is used on 60-cycle power lines, using the normal type of core iron, there will be about 50,000 lines of force per square inch in the core. (The number of lines of force will decrease as the line frequency increases.) Referring to the transformer example above, the secondary is rated at 150 watts, so a core with a cross section of 2-1/4 square inches is needed. A core 1-1/2" x 1-1/2" equals 2-1/4 square inches. Remember, the core area is found by multiplying the sides, not adding. However, this is the minimum size that should be used. If a larger size core is available it should be used as the core losses and the number of turns required are reduced. We will talk more about core losses further on.

A formula has been derived for the number of primary turns: turns = 7.5 x V/A, where 7.5 is a constant for 60 cycles, V is the line voltage, and A is the area of the core. With a line voltage of 120 and a core area of 2-1/4 square inches, this works out to 400 turns on the primary. Then, if we divide 120 volts by 400 turns, we find there are 0.3 volts on each turn in the primary. This also means that every coil in this transformer will have 0.3 volts on each turn. If there are to be 25 volts on the secondary and we want to find the number of turns needed, we divide 25 volts by 0.3 volt per turn and find that 83.3 turns are required. This would be rounded off to either 83 or 84 turns, preferably 84.

The current-carrying capacity of any wire is rated on its diameter in circular mils. Normally this capacity is based on the wire being in the open where air can flow around it. When the wire is confined, as in a thick cable or a transformer, less current should be carried as heat can be generated. The size of the wire used in a small transformer is usually based on 700 circular mils per ampere, which is acceptable for intermittent service. A poorly designed or cheaply made transfomer may use as little as 500 circular mils per ampere, while for continuous service 1,000 or 1,500 circular mils per ampere are used. Wire tables are found in most amateur radio manuals.

Heat is very destructive in a transformer. The normal heat should be about 150 degrees F. If the temperature is higher something is wrong, such as a short circuit between turns, or excessive current being drawn from the secondary. If you can hold the back of your fingers on a transformer for about a minute the amount of heat is within limits. However, some transformers are designed to operate at a higher than normal heat level.

Other Causes of Loss

Besides I^2R (power) losses in the transformer windings, there are three other losses that can cause core heating: eddy currents, hysteresis losses and saturation. Because the core is made of metal it can and will act as a conductor. When magnetic flux from the coils pass through the core, eddy currents will develop. The core has resistance to this flow of current and heat results. Eddy currents can be reduced by using a laminated core, and insulating each lamination with varnish, shellac or iron-oxide. Iron oxide forms on the laminations during their manufacture and it is cheaper than dipping each lamination in varnish or shellac.

Hysteresis losses are also in the form of heat. Whenever a pulse or half cycle of alter-

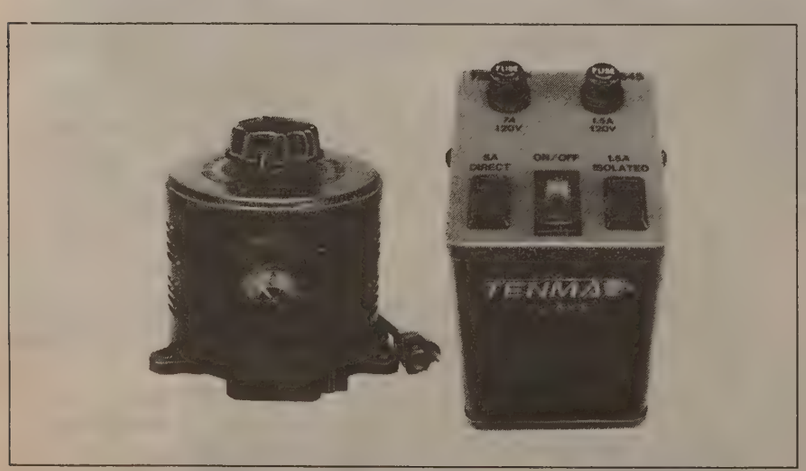

Photo B. Autotransformer (left) and isolation transformer (right).

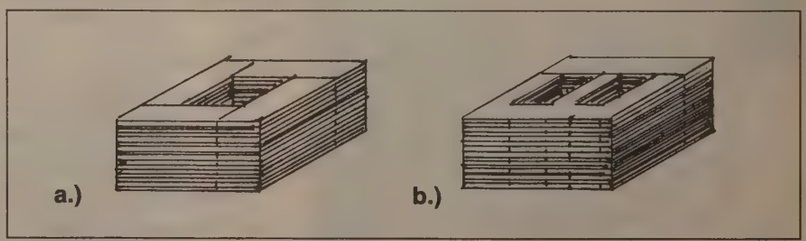

Figure 1. a) Core-type construction. b) Shell-type construction.

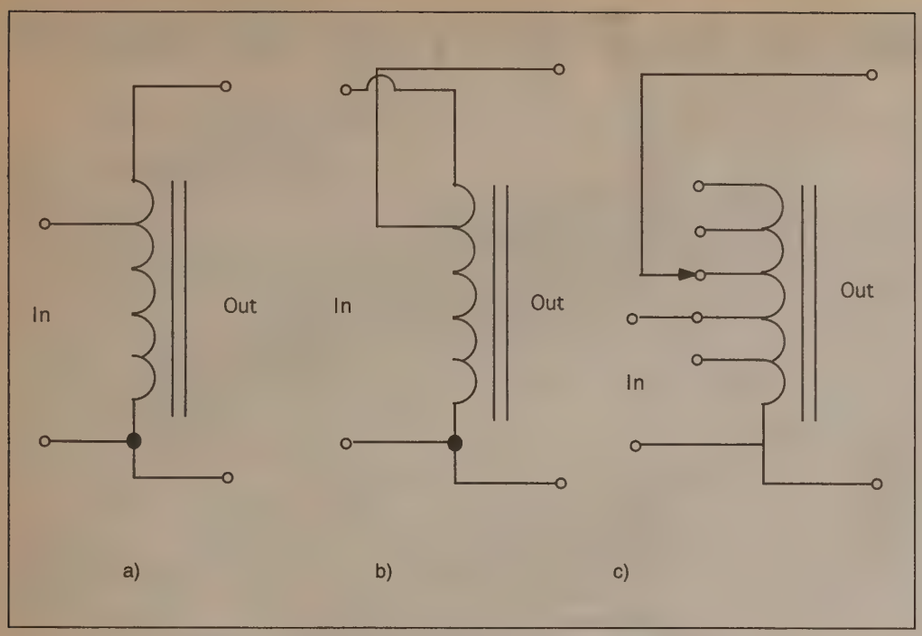

Figure 2. Windings: a) Step-up; b) Step-down; c) Variac.

nating current flows in a coil that is wound on a metallic core, the pulse will cause a magnetic field to be set up in the core. On the next half cycle when the current reverses it will tend to reverse the magnetic field that was set up by the first half cycle and create a new magnetic field. Because of the continuous reversal of the AC, friction develops between the iron molecules and heat builds up as they try to create a new magnetic field.

The core can also be thought of as being like a sponge. A sponge will hold just so much liquid before it becomes saturated and not hold anymore. The same effect takes place in the core—it will reach a point of flux saturation. Upon reaching a saturated condition a large amount of heat will be developed, which in turn heats the coils. A large core will not saturate as easily as a smaller core for the same amount of flux.

All of these losses are measured in watts per pound of core weight. A small 60-cycle transformer may have losses as low as 0.7 watts to a high of 3 watts for each pound of core material. The core losses can account for as much as 10% of the power rating of a small transformer, meaning that a transformer rated at 100 watts is actually good for only 90 watts.

It is necessary to wind the coils in a transformer with insulated wire. Normally enameled coated wire is used. Cotton- or cambric-covered wire can be used but will occupy more winding space. The windings are always insulated from the core by a high grade varnished cloth or paper, and each layer of windings should also be insulated.

Transformer housings are in different shapes, and because of this the ends of the windings terminate differently. The terminations can be in the form of solder lugs, projecting pins, a screw-type terminal strip, or long insulated wire leads. Some means is always made to identify each wire end as to its use. One method is a color code, shown in Table 1. The color code is normally used with transformers having insulated leads.

Types of Transformers

Some other types of power transformers include: isolation, conversion, autotransformer, and Variac. The isolation and conversion types can really be classified as the same, they are both used to isolate the power source from the load. An isolation type has the primary and secondary rated at the same voltage, usually 120 volts to 120 volts, or whatever the line voltage may be. It is used to prevent electrical shock with equipment that has one side of its circuit common to one side of the power source. This type of transformer is rated at the wattage or current that can safely be drawn by the load. An isolation transformer may have a conventional AC outlet receptacle on one side of the housing, and an AC power cord with a plug on the other side.

The conversion type is used with equipment designed for operation at a particular line voltage but is to be used at a different line voltage. The equipment may be made for use in this country on 120 volts, but can be used in another country that has a higher or lower line voltage. Like the isolation transformer, its wattage rating depends on the current that can be drawn from the secondary. The housing may have a receptacle that mates with a plug used in this country, and a line cord with a plug used in the other country. Some countries use 50-cycle AC power instead of 60 cycles, but a 60-cycle transformer will work satisfactorily at a slightly reduced wattage rating.

So far all the transformers mentioned have had two or more separate windings. Yet there is one type, the autotransformer, that has but one winding which does double duty as both primary and secondary. By placing a tap in the proper position on the winding there can be either a step-up or step-down action. It should be noted that a shock hazard is present with an autotransformer as one side of the AC line is common to both the supply and load. Figure 2a shows a step-up winding and Figure 2b shows a step-down winding.

Again, a turns ratio is used on the winding. Referring to Figure 2a, we see that point X is the tap, as well as one side of the power line. With 120 volts input between points X and Y and a turns ratio of 3, there would be 360 turns between X and Y. If we added 15 turns to the top of the tap there would be 375 turns between points Y and Z, and the output voltage between these two points would be 125 volts. This can be seen by dividing the added 15 turns by 3 turns per volt for an answer of 5. In Figure 2b we again assume there are 120 volts and 360 turns between points X and Y, but this time the tap is placed 15 turns from point X towards point Y. With a turns ratio of 3, we find there are now only 115 volts between points Y and Z.

The part of the winding that acts as the primary generates a flux that induces a voltage in the entire winding, including the section that acts as the secondary. However, because of the tap the voltage that is set up in the secondary section is opposite to, or opposes, the voltage in the primary section. Hence, the two currents flowing in the part of the winding that is common to both primary and secondary sections will be nearly 180 degrees out of phase. Since the two currents are in opposition the resulting current is the difference between the two, and the common section of the winding can be wound with smaller wire.

An autotransformer is smaller than a regular transformer for the same voltage and current output because of the size of wire required and less winding area needed. Because of this, autotransformers are used in small plug-in AC-DC adapters for calculators, portable radios, tape recorders, etc., and in small battery chargers.

Another type of autotransformer called a Variac has an adjustable output and is used to compensate for a varying line voltage (Figure 2c). The output of some variacs can be adjusted for line voltages that may range from 30% below to 15% above normal. A Variac is not an automatic device that will maintain a constant output voltage, it will only boost a low line voltage or drop a high line voltage by the amount selected by the tap. If you wish, a Variac may be used ahead of an isolation transformer.

Next month, we will see how to connect two or more transformers in series or parallel for greater output. Also, how to test a transformer, some safety tips, and a few other goodies. RF

Table 1. Transformer Lead Color Codes

Black	Primary.
Black/yellow stripe	Primary tap. Tap may be used with different input voltage.
Black/red stripe	Other end of primary. Red stripe present only if primary is tapped.
Red	Secondary—normally high voltage.
Red-yellow stripe	Center tap of high voltage winding (if secondary is tapped).
Yellow	Low voltage winding. Usually reserved for rectifier tube filament.
Yellow-blue stripe	Center tap for rectifier tube filament.
Green	Low voltage winding #1.
Green-yellow stripe	Center tap for low voltage winding #1.
Brown	Low voltage winding #2.
Brown-yellow stripe	Center tap for low voltage winding #2.
Slate	Low voltage winding #3.
Slate-yellow stripe	Center tap for low voltage winding #3.

Note: Color code originated when vacuum tubes were in use before transistors. The color code for transformers used with transistors remains the same: Black for primary, and usually yellow if there is only one secondary.

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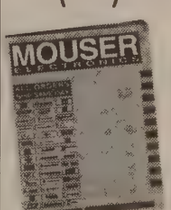

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QRP RF Wattmeter

by J. Frank Brumbaugh KB4ZGC

QRP and QRP_p operators need a simple and accurate means of measuring transmitter power output. It should be inexpensive, simple to calibrate, and capable of monitoring instantaneous RF levels when transmitting.

The wattmeter described here measures RF power from 10 mW to 5 watts into a 50-ohm resistive load. The load can be a dummy load, a perfectly matched antenna, the input to a perfectly matched transmission line, or the input to an antenna tuner providing an SWR of 1:1 to the transmitter. The sensing head is built into a PL-259 coaxial plug body. It plugs into one port of a coaxial T-connector, whose other two ports connect to the transmitter and a 50-ohm load. RF power output is indicated on a remote meter, connected to the sensor through a shielded wire. The meter can be placed wherever convenient, so it may be observed during tests and operation of the QRP station.

Theory

Refer to Figure 1. RF, sensed on the coaxial line between the transmitter and the load, at P1 is applied across the series resistors, R1 and R2. RF is sampled by diode D1 at the junction between the two resistors. This ensures that the diode will not be subjected to excess voltages. D1 rectifies a sample of the RF, which is filtered by C1, and the resulting DV voltage is available at J1.

A shielded wire with RCA plugs on each end connects the sensor head and the indicator containing meter M1. This DC voltage is applied across calibrating trimpot R3 and meter M1 in series, causing the meter to indicate the RF level detected by the sensor head. The meter is calibrated in watts and/or milliwatts.

Construction

See Figure 2. Remove the shell from a PL-259. Carefully file the three places indicated to remove the nickel plating and expose the underlying brass. Also file the base of an RCA chassis-mount jack. It will later be soldered into the open end of the PL-259.

The sensor circuitry is soldered together as shown in Figure 3, making sure the anode lead of the diode is soldered to the junction between the resistors. Dress the leads approximately as shown.

Solder one lead of the monolithic capacitor C1 to the center pin of the RCA jack J1, as close to the pin as possible. Dress the other lead up as shown in the illustration. Using small spaghetti or insulation slipped from a short piece of hookup wire, insulate the cathode lead of diode D1. Then solder the cathode lead to the center pin of the RCA jack, J1.

Make certain all connections are secure. Measure the diode, forward and reverse, to make certain it was not damaged by the heat of soldering.

Carefully insert the sensor into the body of the PL-259. The lead of the lower resistor must extend through the tip, and that from the upper resistor must be guided out through one of the holes in the side of the PL-259. RCA jack J1 must be centered on the upper end of the PL-259, and the unconnected lead from C1 must exit the PL-259 body alongside the RCA jack.

When all is ready, solder the lead at the tip of the PL-259, and also the lead exiting through one of the holes in the side. Allow the connector to cool for several minutes, then solder the RCA jack J1 on the end of the PL-259, making certain the wire lead of C1 is also soldered at the junction between the two connectors. Replace the shell on the PL-259.

The meter, its calibration trimpot, and RCA jack J2 should be mounted in the enclosure of your choice after it has been calibrated, and the meter scale modified to indicate RF power. The sensor head and the indicator are connected together with a shielded wire terminated with an RCA plug at each end.

Calibration

The wattmeter may be calibrated primarily for QRP levels or for the milliwatt levels, or both, as desired. A source of variable DC voltage and an accurate DC voltmeter are required. A digital voltmeter is recommended because it is considerably more accurate than an analog multimeter. The calibration setup is shown in Figure 4. Your station power supply and a 1000 ohm potentiometer together provide the range of voltage needed. Table 1 gives equivalent values of RF power and DC voltages at selected points in the range between 10 milliwatts and 5 watts.

QRP Calibration

Although you can mark as many RF levels on the meter scale as desired, most QRP operators normally set output power between 1 and 5 watts. QRP_p calibration will be described later.

With R3, the 100,000 ohm trimpot, set for maximum resistance and connected in series with 100 µA meter M1, set up the calibration arrangement shown in Figure 4. Adjust the 1,000 ohm potentiometer for 7.90 volts on the DMM, then adjust R3 until M1 indicates slightly below full scale-deflection. Mark this 5 watts on the meter scale.

CAUTION: Do not touch R3 again during calibration.

Reduce the voltage on the DMM to 7.07 volts. Mark the meter scale 4 watts. Continue in this manner with calibration of lower power levels. This completes QRP calibration.

QRP_p Calibration

Because QRP_p operators transmit signals in the milliwatt ranges, having a meter calibrated to include powers above 1 watt would be a waste of meter scale space, making readout difficult. Therefore, this calibration procedure spreads the range below 1 watt over most of the meter scale.

With the calibration setup as shown in Figure 4 and R3 set at maximum resistance, refer to Table 1 and set 3.50 volts on the DMM. Adjust R3 until the meter indicates just below full scale. Mark the meter scale 1 watt.

CAUTION: Do not touch R3 again during calibration.

Reduce the voltage on the DMM to 3.06 volts. Mark this point on the meter scale 750 mW. Continue reducing voltage as indicated in Table 1 and marking calibrated points on the meter scale. This completes calibration for QRP_p power levels.

Operation

Install a coaxial T-connector on the output jack of your transmitter. With a coax jumper, connect one port of the T-connector to a 50 ohm dummy load. Install the PL-259 sensor head in the other port. Connect the sensor head to the indicator with the shielded cable. Turn the transmitter on and key it, noting the power level on the indicator, meter M1. Adjust the transmit power to one of the calibrated levels. Unkey the transmitter.

Remove the 50-ohm dummy load and replace it with the input to the SWR meter/antenna tuner which feeds an antenna. Temporarily remove the sensor head from the T-connector. Key the transmitter and adjust the antenna tuner for an SWR of 1:1. Unkey the transmitter.

Replace the sensor head on the T-connector and operate the transmitter. The indication on M1 will be the same as it was on the dummy load as long as the transmitter is looking into a 50 ohm load. Readjust transmitter pow-

Continued on page 21

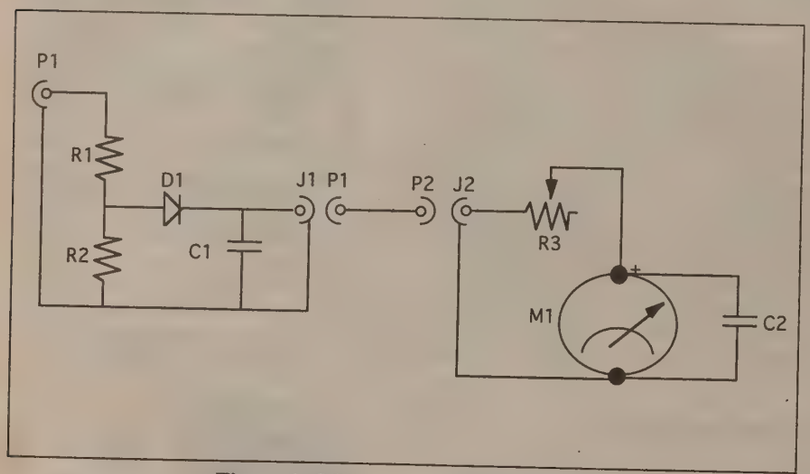

Figure 1. QRP wattmeter schematic.

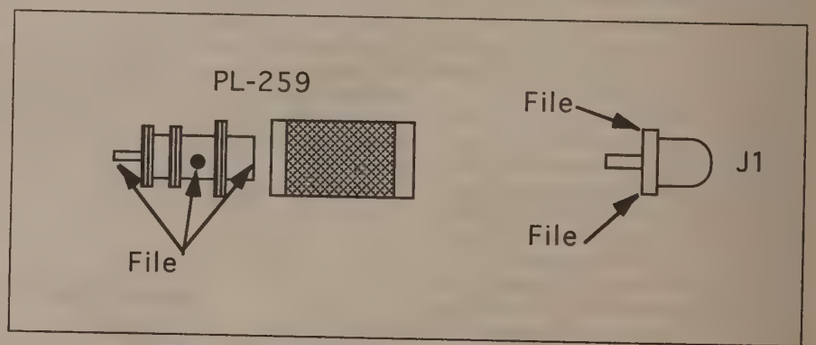

Figure 2. Preparation of PL-259 and RCA jack.

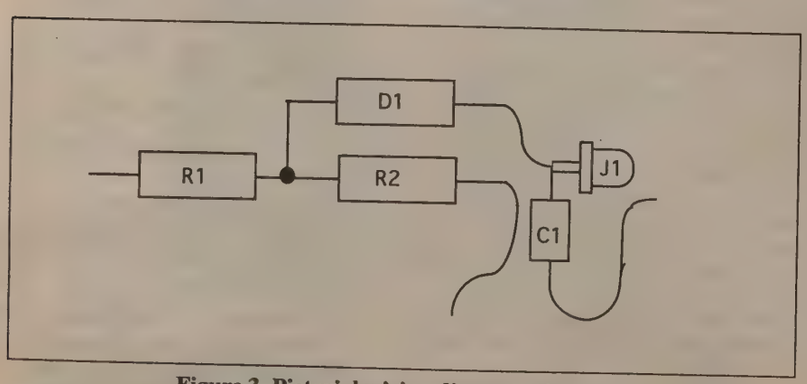

Figure 3. Pictorial wiring diagram of sensor.

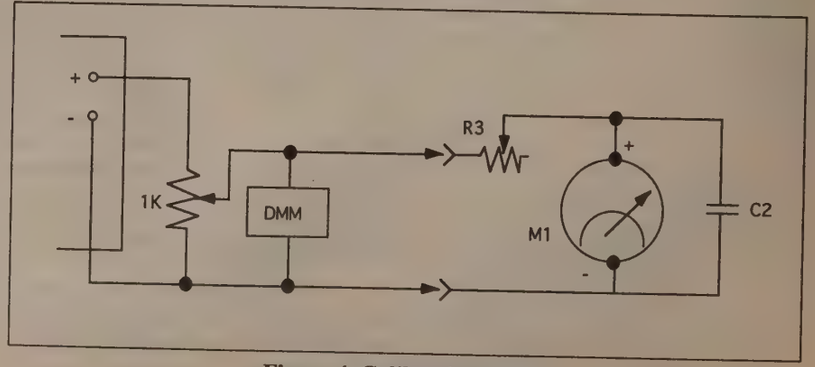

Figure 4. Calibration setup.

Slow-Scan TV Questions and Answers

New low- (even zero-) cost systems make SSTV more popular than ever!

by John Langner WB2OSZ

Q: Why send pictures over the radio?

A: The ancient Chinese proverb "a picture is worth a thousand words" is just as true today as it was thousands of years ago. Vision is our highest bandwidth sense and the primary source of information about the world around us. Material is easier to understand and more enjoyable when images accompany verbal descriptions.

Would you watch television with your eyes closed? Why not make your ham radio contacts more interesting by including pictures?

Q: How much does it cost to get started?

A: If you already have a voice transceiver and a computer, you can send and receive pictures at zero cost, or very close to it. If you're impatient, skip to the last question for details.

Q: How does SSTV differ from ATV?

A: There are basically two methods used to send pictures over ham radio. Fast-scan TV is the same as broadcast TV: full-motion color images. This requires a few megahertz of bandwidth so it is used only on UHF. A single transmission is wider than the entire 2 meter ham band.

The other method is slow-scan TV: still images sent through voice transceivers over a period of a few seconds to a couple of minutes. Early pictures were low-resolution black and white. Now nearly all images are higher resolution color.

You'd expect the term "amateur television" to apply to both fast-scan and slow-scan, but ATV generally means only fast-scan TV.

Q: What kinds of pictures are sent?

A: Reviewing pictures saved during the last few weeks, I found: hams in their shacks, lots of pet dogs, a frog, a kangaroo, astronauts in the space shuttle (SSTV has been transmitted from some missions!), bridges, birds, Elvis Presley, rock formations, an old-fashioned microphone wearing a Santa Claus hat, antique cars, flowers, children, Jupiter, a cow, someone playing bagpipes, many colorful butterflies, boats, and cartoon characters with personalized messages. Many SSTVers show off their artistic abilities by sending pictures they made with paint programs.

Q: How is the image quality?

A: Not as good as the usual 640 x 480 VGA pictures with 16 million colors we are accustomed to. Most are about half that size (320 x 240) and in full color.

Q: What frequencies are used?

A: Some countries are more restrictive, but in the U.S. SSTV can be used anywhere voice is allowed. Traditionally, certain frequencies have been used as meeting frequencies:

3.845
3.857
7.171
14.230
14.233
21.340
28.680
145.5 MHz

20 meters is generally your best bet for finding activity. 80 meters is also popular.

Q: What class of ham license is required?

A: If you are allowed to transmit voice, you are allowed to transmit SSTV on the same frequencies. The one exception is the Novice/Technician 10 meter segment.

Q: Are there any nets?

A: Saturdays at 15:00 and 18:00 UTC on 14.230 MHz.

Q: Are there SSTV contests?

A: There are the usual types of contests where participants try to make the maximum number of contacts in a certain amount of time.

There are also contests for the best pictures. The theme is usually the nearest holiday. For example, around Halloween there is a contest for the best images with a Halloween subject matter. There are different categories for natural and computer-generated images.

Q: Is SSTV new or has it been around for a while?

A: Amateur SSTV has been around since 1958.

Q: Why don't the majority of ham magazines and handbooks mention anything about SSTV?

A: There were many articles in the early days when most people home-brewed their own equipment. In the 1970s and 1980s most people bought commercial equipment and exchanged pictures. Few people could afford the expensive equipment and there really wasn't much to write about.

In the last couple of years, many new low-cost SSTV systems have become available and thousands of hams have discovered the fun of SSTV, despite the difficulty in finding information. Ham radio magazines in Europe and Japan constantly have articles on SSTV. I have no idea why the American publishers continue to ignore it.

Q: How has equipment changed over the years?

A: SSTV started out with surplus radar display tubes with very long persistence ("P7") phosphors. This allowed an image to be painted on the screen over a period of a few seconds.

When memory chips became affordable, scan converters became feasible. Scan converters translate one TV standard to another. In this case the scan converter takes video from a TV camera (e.g. camcorder) and translates it for SSTV transmission. In the other direction, it stores an SSTV image in memory and allows it to be displayed on an ordinary TV set.

The latest trend is to use a personal computer, software, and an interface attached to your transceiver. This is much less expensive and much more flexible.

Q: What kinds of commercial equipment are available?

A: There are basically two types: dedicated scan converters and PC-based systems. The legendary Robot 1200C scan converter was discontinued about two years ago but other new products such as the SUPERSCAN 2001 and TSC-100 have moved in.

PC-based SSTV systems abound: Pasokon TV, SSTV Explorer, ViewPort VGA, and PC SSTV 5 all have their own hardware interfaces that connect the computer to a transceiver. Some multimode TNCs can handle SSTV with optional software. You can even use a Sound Blaster with the Slow Scan II software.

Consult the ads in ham magazines like *73 Amateur Radio Today* and *Radio Fun*, for more information.

Q: What are the trade-offs between special purpose scan converters and PC-based systems?

A: Dedicated scan converters offer some advantages: You plug in the cables, turn on the power, and they work. You don't need a computer. However, they are expensive.

Most people with scan converters use a computer, anyhow, to store images, so why not use a low-cost interface and let the computer do most of the work? This is also more flexible—new features are distributed by floppy disk instead of hardware changes. There are two major disadvantages. First, none of the current systems allow you to run SSTV concurrently with other applications. Second, there are occasional conflicts or incompatibilities when adding new hardware and software to a computer system.

Q: Where do I plug in my TV camera?

A: The dedicated scan converters all have video input, but none of the current PC-based systems do. Capturing an image from a TV camera, such as a camcorder, requires an extra device called a frame grabber. Of course, frame grabbers have many other uses besides SSTV and new models are continually being introduced by many manufacturers.

The bad news is that frame grabbers require a fair amount of high-speed specialized circuitry and memory. The good news is that prices are tumbling due to new technology and increased competition. The same product that had a list price of $600 about a year ago can now be found for about $300. Innovative new products, such as "John's Frame Grabber," demonstrated at the 1994 Dayton Hamvention, will provide better image quality at even lower prices.

Q: What should I look out for when buying new or used equipment?

A: There are many transmission modes in use. Make sure the system can receive all the popular ones. If you were to pick up an old Robot 400 (black and white only) system at a flea market, you'd be very disappointed to find out no one sends B&W pictures anymore.

There is a wide variety of features available. Consider image quality, ease of use, documentation, price, and so on. Get on the air. Talk to people. Ask what they are using and how they like it.

Q: What plans are available for home-brewing?

A: Magazine articles in the last couple of years:

73 Amateur Radio Today—August 1992
QST—January 1993
QST—January 1994 (Hmm. Is January the annual SSTV issue?)
Radio Fun—this issue!

Q: Are there any handbooks or newsletters dedicated to SSTV?

A: There are only two modern SSTV handbooks: *Slow Scan Television Explained* by Mike Wooding G6IQM (1992—ISBN 0-9513779-3-0); and *SSTV Handbook*, whose primary author is JA6OAC but the rest is hard to decipher because it is in Japanese (1994—ISBN 4-7898-1011-9 C3055 P4500E). The 1995 edition of the *ARRL Handbook* has a completely new and greatly expanded section on SSTV. The International Visual Communications Association (IVCA) has a newslet-

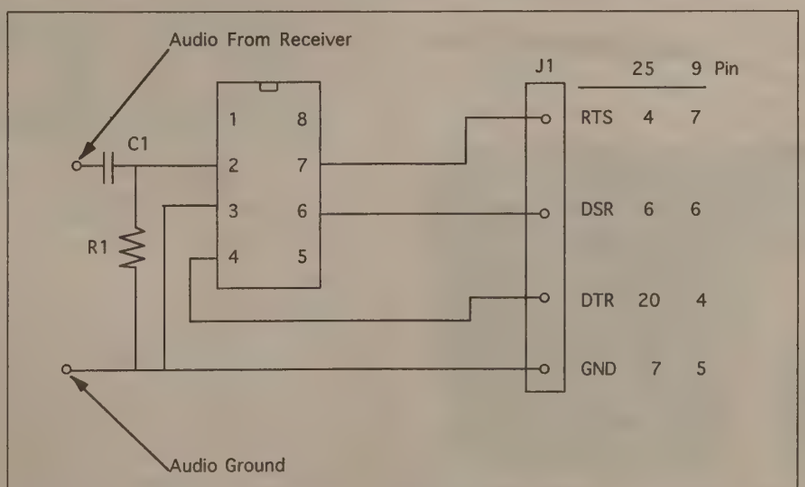

Figure 1. A well-stocked junk box probably has all the parts to make this interface. The resistor and capacitor values are not critical. Use either a 25- or 9-pin connector depending on the type of serial port available.

Continued on page 21

RF review

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AEA Morse Code Trainers

by Gordon West WB6NOA

When you think about the Lynnwood, Washington, company Advanced Electronic Applications (more commonly known as AEA), you think about their fabulous reputation in packet controllers, the PK-232 multimode controller, the AEA IsoPole, and their popular AEA IsoLoop antennas. If you are into computers, you may also know the AEA weather facsimile program as well as AEA Log Windows software and PC-Pakratt software.

Did you know that AEA does code, too? That's Morse code . . . dots and dashes . . . dits and dahs . . . long sounds and short sounds!

Ever since the company was formed by Mike Lamb N7ML, AEA has always offered Morse code training "machines." "Amateur operators who have been licensed for more than 25 years will certainly remember the perforated tape code machines—you might say that our 'Morse Machines' are a refinement of that early technology," comments Lamb.

A big refinement. When you slowed down the old paper-tape code machines, it dragged out the dots and dashes. Code teachers are just about unanimous in saying this is not good—you should always learn the code at a character rate between 15 wpm to 20 wpm, and give spaces in between each complete character to slow down the word speed to anything you want, from 1 wpm on up. This is called the "Farnsworth" method of learning the code, and all AEA Morse Machines allow you to independently set a faster character rate for any word speed setting.

The AEA MM-3 is now in its 10th year of design refinements. It is a four-way code instructor:

1. Random code groups with steadily increasing speed—ideal for practicing the new commercial radiotelegraph CW requirements.

2. Random word generator that gives you four-letter words to double-check your code copy.

3. Almost-live QSO simulator to give you the feel for sitting for your actual code test, or better yet, actually going on the air with CW.

4. DX contest simulator, a fun way to turbo-charge your code copy capabilities to better understand abbreviations.

The MM-3 is a perfect match to a Bencher paddle or a Bencher straight key. This allows the code instructor to send both live code and canned messages. Speaking of canned messages, the MM-3 is ideal for Field Day or contesting because it will also serve as a beacon that you pre-program with your callsign, grid square, and anything else you would like repeated over and over again.

The MM-3 also goes ASCII, and when hooked up to a simple computer like an everyday Radio Shack 100, you can type in your message and have it come out on CW—or send CW with the paddles, and have it read out on the computer.

With computers so popular at the ham shack, AEA has just introduced the KK-1, a keyboard keyer that works off of your existing computer keyboard. The KK-1 keyboard keyer features built-in iambic keyer, four-digit LED readout with mode indicators, analog speed control with the big knob or keyboard entry of speed, along with a built-in sidetone oscillator and speaker. The KK-1 also has a 12-port memory message system, dynamically allocated and nestable. It will hold around 8,000 characters, and can send those at a character rate of 5 to 90 wpm and a sending speed rate of 5 to 90 wpm.

Photo A. The CW speed adjustment is independent of the fast Farnsworth character rate.

For code instructors, the KK-1 offers automatic code practice with selectable character types and group lengths, plus random words. You can see where some of the neat features from the original MM-3 have been carried over to the memory code practice modes of the KK-1.

"The best part of the KK-1 is the multiple message buffers which allowed me to enter text ahead of time and send it when appropriate to my students," comments Bill Alber WA6CAX, a ham radio instructor from Central California. "I can begin sending a live message by typing on the keyboard, and then insert the contents of my message buffer instantly by pressing the corresponding function key. My students don't know if I'm sending live or from a buffer," smiles Alber. "This allows me to start out live, but then switch to canned messages that I have created-or that the KK-1 creates—so I can walk around the room and check the progress of each student," says Alber.

Another great feature of the KK-1 is the ability to correct errors when sending from the keyboard or loading a message into the buffer. Simply press the backspace key to delete the last key entered—or, if it was a double character key, such as AR or SK, the backspace key will delete it as a group. You can also delete the last-entered word by pressing shift-backspace. This function deletes at least one character, then continues deleting backwards until a word space is found, or until the buffer is empty.

To enter the code practice mode for self-instruction, press shift, enter a number on the keypad, and press shift-alt. The number you entered determines the maximum length of the character groups that will be sent, and the type of characters that will be used for your personal code practice. It also includes a starting point, or seed, for the random character generator. For example, if you enter 1-2-3 shift-alt, the KK-1 assumes a left-hand digit of 0, and therefore sends random length groups of letters and numbers, using a seed of 23.

If you press shift-alt with no numerical entry, the KK-1 will select a random speed, and send groups of commonly-used one-to-six-letter words, including some Q signals and acronyms from a list of over 700. This mode is great for learning to recognize the sounds of common words found in typical QSOs.

And most certainly you can hook up your Bencher paddles or straight key from Bencher to the KK-1 for forming perfect dits and dahs. The character formation speed and waiting will be the same as you set for keyboard sending. The average sending speed setting is ignored, since you determine the character and word spacing when using the paddles. The dot and dash paddles may be swapped without rewiring by holding down the right shift key while pressing delete.

The MM-3 and the KK-1 are AEA's commitment to the preservation of Morse code in the amateur radio service. "With over 340 years of licensed amateur radio experience, our staff has a unique perspective on the needs of our fellow amateur radio enthusiasts," comments Rod Proctor N7UDD, president of AEA. "And we're not just committed to pro-

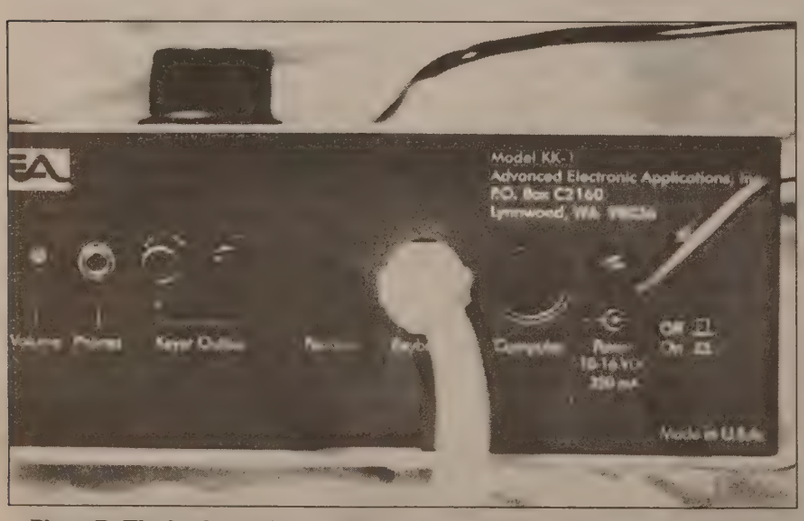

Photo B. The back panel on the KK-1 has all the jacks you need to tie this unit into your on-the-air ham rig.

viding the best in technology—we're dedicated to providing the best overall experience through our $1,000 amateur ambassador award as just one more way we use to promote amateur radio," adds Proctor. This award is intended to recognize amateur operators who promote amateur radio to those outside the hobby.

Soon AEA will announce a revolutionary new code-learning program, especially geared for kids who enjoy interactive computer games. "We have a powerful code-learning program that gets so interactive that even the code pros at 30 wpm won't want to put down the keyboard and go to bed," smiles Proctor. I have tried this new program myself, and it will lead to literally hours of keyboard fun and education.

AEA welcomes comments from the amateur community on their products—especially comments from instructors who teach the code using AEA code-training equipment. Write or phone: AEA, P.O. Box C2160, Lynnwood, Washington 98036, or contact Rod Proctor at (206) 774-5554.

All Gordon West Radio School code-training programs use a selection of AEA Morse Machine equipment to generate the perfect-sounding dits and dahs. RF

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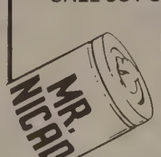

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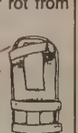

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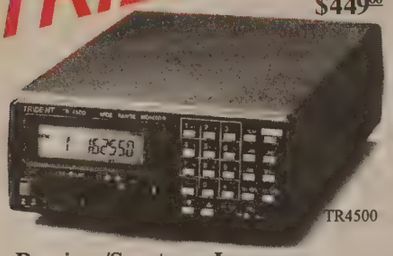

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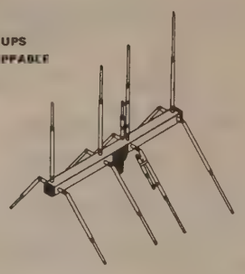

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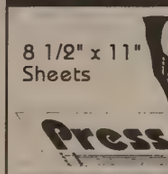

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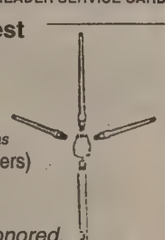

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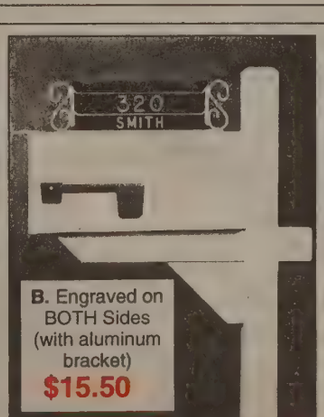

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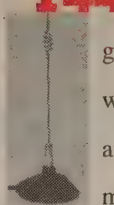

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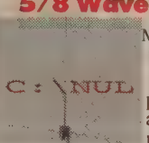

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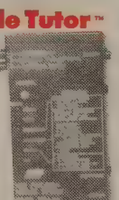

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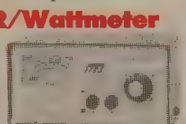

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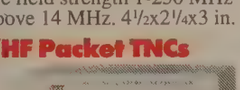

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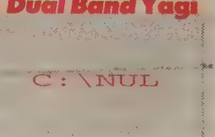

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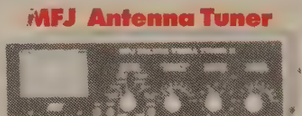

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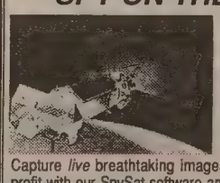

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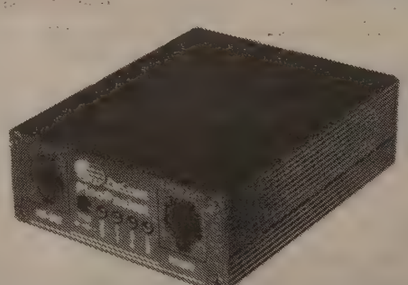

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128k, 256k, 512k, or 1mb RAM.

Full-time GPS port (second serial port).

Smart Battery. A special battery pack which uses two AA cells to generate 5vdc.

Mating GPS receiver. A Trimble SVeeSix-CM2 receiver fits in a separate case the same size as the Pico and attaches via an audio stereo cable.

Available March 30th.

CIRCLE 152 ON READER SERVICE CARD

RF user report

Black Feather Electronics
645 Temple #7
Long Beach CA 90814
Telephone: (800) 526-3717
Price Class: Part No. PM-1,
$17 plus $3 S&H.

All Electronics Corp.
P.O. Box 567
Van Nuys CA 91408-0567
Telephone: (800) 826-5432
Price Class: Catalog number PM-128,
$18 plus $4 S&H.

The PM-128 Digital Meter

Here's a neat addition for your workbench projects.

by Stephen James Erst W9QHV

Digital meters are easily adapted to your project. For the price of a quality mechanical meter, the PM-128 3-1/2-digit digital panel meter may be used to measure voltage or current in your circuitry. The meter has a 200 millivolt sensitivity (0.2 volts). It features 13 millimeter LCD (liquid crystal display) characters. An example of the display is shown in Photo A. Physically, the meter is 6.8 by 4.4 centimeters in size and presents an attractive appearance. The meter requires a supply voltage of 9 to 12 volts and can easily be powered by a 9 volt battery at a current consumption of only 1 milliampere (0.001 ampere).

The meter has an input impedance of greater than 100 million ohms without external attenuators and the polarity (+ or -) is automatically indicated. The accuracy is specified to be within 0.5 percent.

Measuring Voltage

To use this meter to measure values of voltage greater than 0.2 volts, external resistors must be used. Table 1 shows resistor values and the decimal point selection necessary to measure voltages of 2, 20 and 200. This would cover most applications.

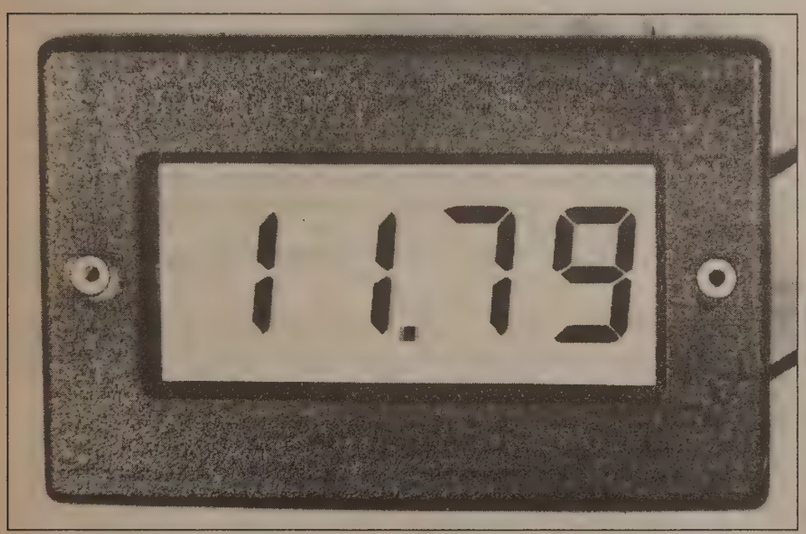

Photo A. The PM-128 digital panel meter with 13 millimeter characters.

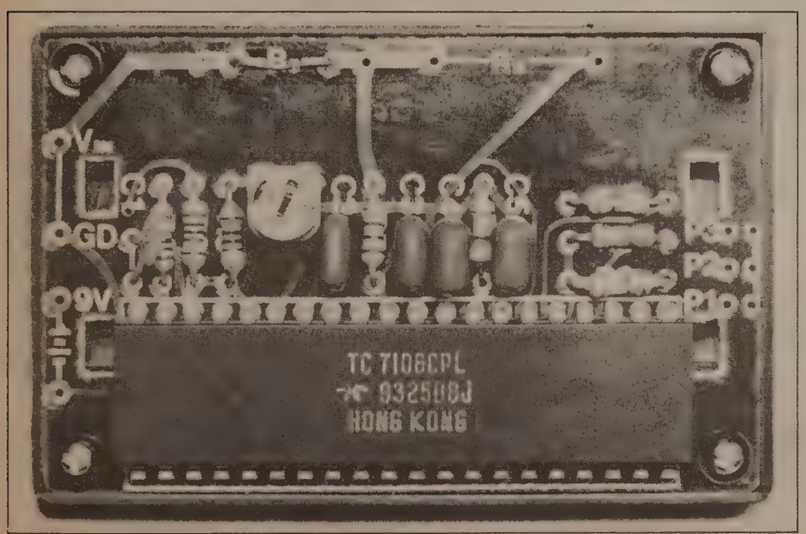

Photo B. Circuit side of the digital panel meter, showing connecting points.

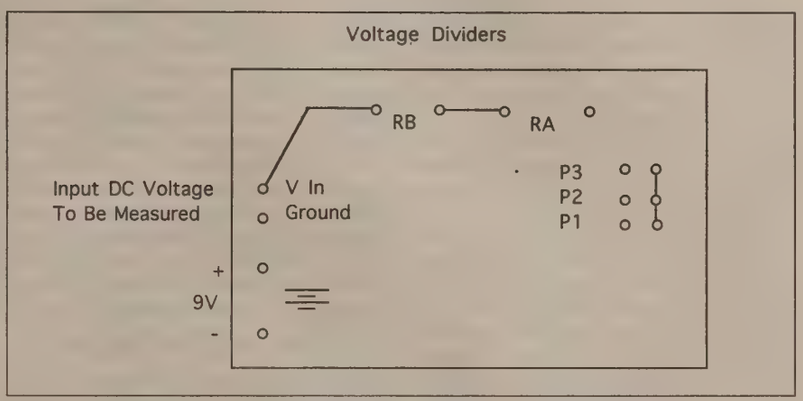

Figure 1. Connection diagram showing the circuit side.

The circuit side of the meter is shown in Photo B. When connections are made to the circuit side of the meter, a small soldering iron tip must be used and the connections should be made quickly.

The connections to the meter are illustrated in Figure 1. When the meter is shipped, the RA and RB resistor pads are shorted. These shorts must be removed for some of the configurations. RA is the shunt leg of an L attenuator where RB is the series leg. Using these resistors, the attenuation to the meter is RA/(RA+RB). Any input voltage to the meter is multiplied by the value of attenuation before the meter sees it. The maximum value of the voltage to the meter must be 200 mV. An over-range condition is indicated by a "1."

As an example, consider the 20-volt range:
20 volts times RA/(RA+RB),
20 times 100k/(9.9 meg+ 0.1 meg) = 0.2 volts, 200 mV.

Note: Using 10 meg for RB would have resulted in a reading of 198 mV instead of 200 mV.

Use as an Ammeter

To use the meter as an ammeter, a 1 ohm resistor is placed between the positive side of the project's power supply and the project. The digital meter is then used to measure the voltage across the resistor. From Ohm's law, current is equal to the voltage measured across the 1 ohm resistor divided by the value of that resistor. Since the resistor value is 1 ohm, the current is equal to the value indicated. The meter will read up to 200 milliamperes using the 200 millivolt range connection.

The 1 ohm resistor needs to be 1/4 watt minimum. It can be made up of 10 parallel 10 ohm resistors. You can use Radio Shack 271-1301 or 271-001. An overkill is Radio Shack's 1.0 ohm 10 watt resistor, 271-131. While oversized, it is the best priced of the choices and would be useful for higher current purposes.

The configurations may be modified to suit the user's needs. For example, if the voltage divider is set to provide a 2 volt maximum range and this range is used to measure current with the 1 ohm series resistor, a 2 ampere maximum range is secured.

The meter is a joy to use. No longer is it necessary to redraw scales or interpolate readings as with a mechanical meter.

The digital meter is available from either of the two suppliers listed above. Black Feather's part number is PM-1; All Electronics Corporation's catalog number is PM-128. RF

Voltage Range	Dividers (Ohms) RA	RB	Decimal Point Selection P1	P2	P3
200 mV		Short			Short
2 volts	1 meg	9 meg	Short		
20 volts	100k	9.9 meg		Short	
200 volts	10k	9.9 meg			Short

Note: For most purposes, a 10-megohm value will suffice for RB.
A blank indicates an open connection.

Table 1. Table of resistance values and decimal point connections for 0.2, 2, 20 and 200 volt applications.

RF user report

Timewave Technology
2401 Pilot Knob Rd.
St. Paul MN 55120
Telephone: (605) 886-7314
Price Class: $279.95

Timewave Technology's DSP-59+

by Dave Miller NZ9E

I've always really disliked noise—white noise, pink noise, whatever the color. It really grates on me after a while. Perhaps it's because of my many years in the broadcasting industry, where noise was always something to chase down and eliminate. Or perhaps it's a quirk in my ear-to-brain interface. Whatever the reason, I'll do almost anything to eliminate noise in my listening environment.

I've generally been first in line to try new noise limiters, noise blankers, low-noise preamps, etc., as they've popped up over the years, but nothing up until now has really cut it. Oh sure, they all worked, to an extent, but none really *eliminated* random (or even not-so-random) noise, not until the introduction of true digital noise reducers. They've made a real dent in noise elimination—the type of noise our HF bands are famous for.

I bought the W9GR DSP (Digital Signal Processor) kit shortly after it went through a re-design and the new, multi-program units became readily available. What a difference! Here was finally something that made real inroads in noise *elimination!* Mind you, the new breed of digital signal processors won't eliminate all of the noise on your HF receiver, but 20 dB or so is nothing to sneeze at, and that's approximately what they'll do today. Perhaps in the future someone will develop a *total* noise eliminator, but for now I've been very pleased with that 10-times or so reduction in my most dreaded nemesis, noise!

I was very pleased with the W9GR DSP, but we now seem to be entering *stage 2* in the digital signal processing arena and it looked like it might be time for a change. Timewave Technology, of St. Paul, Minnesota, recently introduced their DSP-59+, which not only offers up to 20 dB of noise reduction and 50 dB of tuner-upper-heterodyne reduction, but a full-blown variable passband customizer (they call it a filter) so that you can select exactly how much of the normal 300 to 3,000 Hz SSB signal you want to let through to your speaker! For CW and the data modes, you can select how wide a chunk of spectrum you'll allow through, from as much as 600 Hz down to 25 Hz. You can also select the center frequency that you prefer to listen to for CW or the center frequency standard for the data modes. On the data mode issue, you're covered from HF packet up through G-TOR (the newest mode from Kantronics), and probably into the future with selectable center frequencies and adjustable bandwidth options galore.

Photo A. Front view of the Timewave DSP-59+ digital signal processor. Left to right are the 1/8″ headphone jack with NORMAL and OVERLOAD LEDs directly above it. The small square push-button switches for controlling the DSP's functions are first BYPASS then AGC ON/OFF, HIGH PASS/LOW PASS & BANDPASS, TONE NOTCH/TONE GENERATE, and finally NOISE REDUCTION ON/OFF. The leftmost knob controls the amount of low frequency cut introduced in the HP/LP mode or the center frequency chosen in the BP (bandpass) mode. The next knob controls the amount of high frequency cut introduced in the HP/LP mode or the total bandwidth chosen in the BP mode. The far right-hand knob is the POWER ON/OFF and AUDIO GAIN control for the built-in audio speaker driver amplifier.

Customize with Sliding Windows

Perhaps the easiest way to visualize how the Timewave DSP-59+'s variable passband "customizer" works is with an analogy. Picture two horizontally sliding windows that meet in the center, allowing more or less of the total window surface area available to be exposed to the room. This is kind of how the DSP-59+ works. With both sliding windows fully open, air comes through the entire window surface. If the left sliding window is partially closed (relating back now to our receiver's passband), less of the *low* audio frequencies come through. Unfortunately, this is known as a high-pass filter, but just remember that you're cutting off the lower audio frequencies. Now if we also close part of the right sliding window (again going back to electronics), less of the *high* frequencies come through—and, of course they had to call this a low-pass filter, but again, think of it as cutting down on the high audio frequencies. That high-pass/low-pass business is technically correct, of course, but it messes up my mind when I'm trying to picture exactly what I'm doing, so I try to ignore it and just think about cutting back on the low frequencies with the left knob on the DSP-59+, or the highs with the right knob—at least the location of the knobs makes sense with the sliding window example and with the way we normally visualize the audio spectrum. The DSP-59+ is also clearly labeled so you shouldn't have any real trouble with this. It's another of those things that's harder to explain than it is to do.

So in essence, with the DSP-59+'s high-pass and low-pass filtering, you can customize exactly how much of the 300 to 3,000 Hz normal SSB bandwidth you will allow to reach your speaker! If QRM creeps up from below, cut off more lows with the left knob. If it sneaks in from above, cut off more highs. You can only go so far with this before you start cutting off too much "intelligibility," but how much is too much is largely a matter of personal judgment and will vary from one situation and one voice to another. The important point is that the DSP-59+ puts *you* in charge of that, it lets you judge how much audio passband you want to cut, on either end, eliminating at least some of the adjacent channel QRM in the process. By the way, this high frequency/low frequency cutting isn't exactly continuous like I've made it sound so far, but rather in steps of 50 Hz, which is just fine because your ear doesn't really require any finer steps than that.

This same analogy, the sliding window concept, holds more or less true for the CW and data "customizing" (OK, *filtering*) scheme as well. In the CW and data mode case, the *center* of the window is selectable, i.e. where the two windows meet, and the two sliding windows themselves move the same amount (opening more or closing more) with just *one* switch—the right switch selects this band of audio frequencies that's passed through and it's called the bandpass mode.

By the way, these three actions, noise reduction, heterodyne elimination and passband customizing can all be going at the same time, or they can be selected individually in any combination on the DSP-59+. That's quite a bit going on in terms of computing, and it's an important feature.

Added Features

Timewave decided to add a few more items to their new model. The DSP-59+ sports an internal AGC amplifier, something that I added to my W9GR DSP after a short period of use at my QTH. Here's the problem: DSPs tend to be pretty level-sensitive, i.e. they like to have a fairly consistent audio level going into them to perform properly. They particularly object to too much audio input from the receiver; they start to distort quite a bit (break up is probably a better description). An amplifier with AGC action ahead of the analog-to-digital converter helps in many cases, most noticeably when the feed receiver's AGC may not be quite up to par. Even on some of the newer transceivers, the internal AGC/AVC isn't all that great. On the amateur HF bands, with signals fading and variations in audio levels—one blasting, another almost undetectable—the built-in AGC action in the DSP-59+ can be very handy indeed. On the downside, some loss of noise reduction can be noticed on pauses during SSB

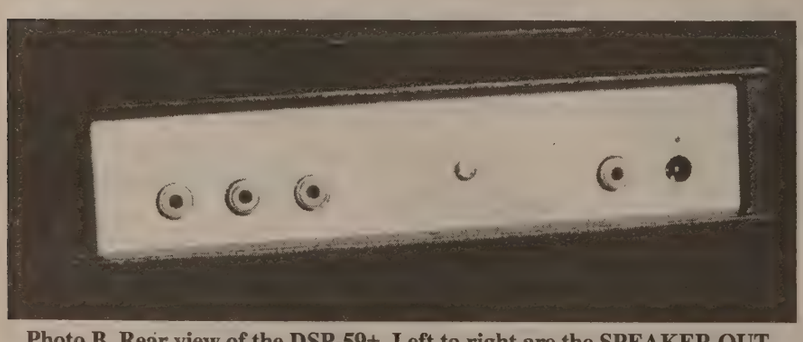

Photo B. Rear view of the DSP-59+. Left to right are the SPEAKER OUTPUT, LINE OUTPUT and AUDIO INPUT connectors. On the right side are the PTT input and DC POWER input connectors. Removal of the front and rear bezels, with two Phillips-head screws on each side, allows the top cover to be removed for internal jumper changes.

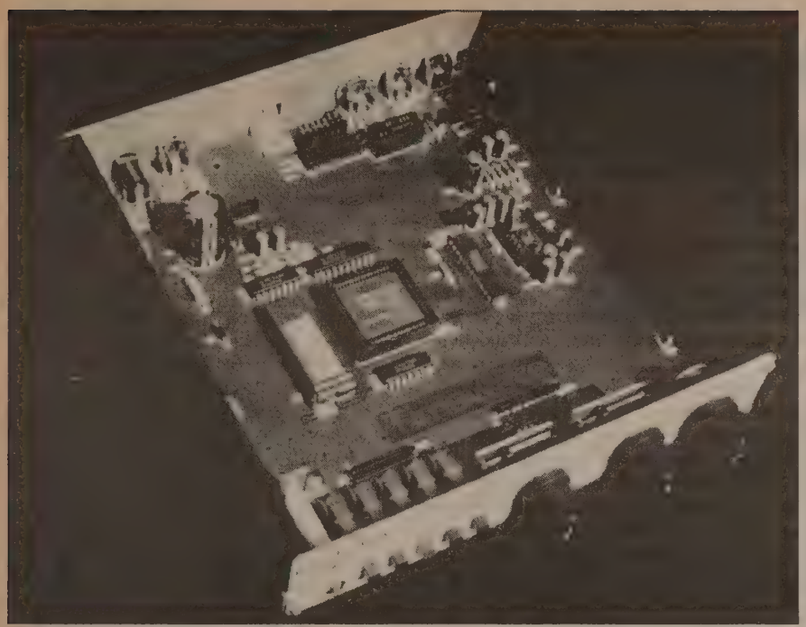

Photo C. Interior view of the DSP-59+. Its seemingly simple layout and clean construction mask its overall complexity in terms of computing power. The internal user-selectable jumpers are located mid-board and at the extreme rear, just to the right of the "L" bracket which provides additional support to the rear panel. These jumpers allow the end user to make a number of choices in the operational aspects of the DSP-59+, but will normally be left in the factory default positions.

speech as the AGC amp brings up (amplifies) the noise floor. Again, it's a judgment call on the part of the operator: You can switch it in when it helps, switch it out when it doesn't. This is a great feature for Timewave to have included and I for one am glad they did.

The DSP-59+ also has a switch-selectable *true bypass* feature built in. The bypass function is accomplished with a relay, so even if you lose power to the DSP-59+ (accidentally or for whatever reason), the relay will put the unit into the bypass mode and things are just as they were before you had the DSP in-line. That was thoughtful design planning. It also allows them to do one of the neat things on the DSP-59+'s final feature: bypass the unit during CW key-down.

The final main feature of the DSP-59+ is that when you're operating CW, you can hear your transceiver's sidetone oscillator even though the DSP-59+ may be tuned to a somewhat different CW tone. This is because the DSP will go into the true bypass mode every time you key your transceiver, as long as the PTT (Push-To-Talk) input on the DSP-59+ is wired to your transceiver's PTT line output (not usually too difficult to accomplish). On SSB, that same PTT line from your transceiver will mute the DSP-59+ so that no spurious audio comes from the speaker during your own transmission times (not an uncommon event with most DSPs).

There's a 1/8" headphone jack on the DSP-59+'s front panel, along with a couple of LEDs to show you when the audio level out of your transceiver is correctly set, but other than that, we've pretty much covered the features of this nice-looking, well-made unit.

You'll need to supply your own source of 12 to 16 VDC for powering the DSP-59+, but Timewave does include the correct plug to mate with their unit. Any well-filtered 12-volt source is adequate just as long as it will deliver about 1 amp of current on audio peaks (you may even be able to "borrow" 12 VDC from your transceiver's accessory connector if it's available there).

Author's Suggestions

One thing I did notice is that Timewave forgot to add a "power on/off" LED, but then a number of manufacturers seem to think that's an unnecessary item these days in amateur equipment. Perhaps they're right, but I still like to see one even though there may be other ways to tell if a device is actually on or off!

I'd also suggest that you try several different speakers with any digital signal processor you might buy because the speaker used can often make quite a difference in the way a particular unit sounds. It isn't always how much a speaker costs, either, that determines how well it sounds with a DSP, so it's difficult to predict which will sound the best ahead of time. Just try several and judge for yourself on this.

One other thing I would like to see the manufacturers add in their DSP lineups is an audio input source selector switch. To be sure, a digital signal processor (like the DSP-59+) works amazingly well on the HF bands, but if you ever operate 6 meters, 2 meters or higher VHF/UHF SSB or CW, give it a try on these bands too. I've found it to be a big help on the VHFs and up, especially in the area of noise reduction—you already know how I feel about noise! That's where the input selector switch would be a real help, using one DSP unit fed by multiple transceivers. Another worthwhile addition would be the inclusion of a "Speaker 1/ Speaker 2" switch for those times when a choice of a couple of different "speaker-sounds" or reproduction characteristics would be advantageous. I've added these switches externally myself, but it would be neater to have them already in the DSP-59+ or other DSP unit—manufacturers please take note.

Timewave came up with a very nice-looking and well-shielded cabinet for their DSP, and have also taken the time to add RFI filtering to the input/output leads. Being digital devices, with lots of steep, harmonic-filled waveforms inside, DSPs can and do radiate some radio frequency interference. The DSP-59+ should be less of a problem on that score than perhaps some others, but don't be too surprised if you find some RF leakage on some band. It's almost inevitable.

I found the DSP-59+'s switches fairly easy to remember as to what-does-what (as long as I think about the sliding window analogy) as well as smooth in operation (the rotary switches for bandwidth selection rotate very easily and quietly).

The unit, from my standpoint at least, is very logically laid out and I wouldn't really change anything if I had the choice—I can't say *that* about very many things these days!

The inside of the DSP-59+ looks starkly simple, belying its tremendous complexity within those few "master" chips! There are a series of eight jumpers that the owner can change to further customize the DSP-59+, but I found that the default selections made by Timewave before the top cover was put on at the factory were quite satisfactory for my operating, and they probably will also be for yours, but the customizing options are there if you ever need to change things, and that's nice too! RF

QRP RF Wattmeter

Continued from page 12

er output as desired, being guided by the indications on meter M1.

Parts

The only parts which may not be in your junk box or at Radio Shack are the 100 µA meter and multiturn 100k pot. A single-turn trimpot can be used, but a multiturn pot will be much easier to adjust accurately. *Note: If you have a 50 µA meter you can use it, but R3 will have to be at least 200k ohms.*

Sensitive meters are very expensive new. A great many very suitable meters are available from Fair Radio Sales, Box 1105, Lima, OH 45802; (419) 227-6573, Fax (419) 227-1313. All are surplus, most are used, and some are new. Also available is a "potluck" assortment of five meters of their selection—you don't get to pick and choose!—but for $10 (Catalog No. 47-84) it's hard to go wrong. It so happens that $10 is their minimum order size. In my personal experience, having purchased four or five such assortments from them in the past few years, there has always been at least one, and usually two or three, µA meters included. Some meters may be square or round, 2" or 3" in diameter, sealed or easy to open, but all have d'Arsonval movements and are in operating condition. If you feel lucky, this meter assortment is a good deal, and you will find uses for the extra meters. RF

Parts List

C1	0.1 µF, monolithic ceramic
C2	0.01 µF disc ceramic
D1	Germanium diode, 1N34, IN60, IN90, etc.
J1,J2	RCA jack, chassis mount, screw type
M1	100 µA DC meter (see "parts" section of the text)
P1	SO PL-259 UHF connector
P2,P3	RCA plugs
R1,R2	4.77 ohm 1/4W, 5%
R3	Multiturn trimpot 100k-200k

Table 1. Equivalent Values of RF Power and DC Voltages

Power	Volts
5 W	7.90
4 W	7.07
3 W	6.12
2 W	5.00
1 W	3.50
750 mW	3.06
500 mW	2.50
250 mW	1.76
100 mW	1.12
75 mW	0.97
50 mW	0.79
40 mW	0.707
30 mW	0.612
20 mW	0.50
10 mW	0.35

Slow-Scan TV Questions and Answers

Continued from page 13

ter in addition to its nets, contests, Dayton booth and other activities (IVCA, P.O. Box 140336, Nashville, TN 37214).

Q: Where can I get more information on this fascinating mode?

A: For a more detailed information package, send a large self-addressed stamped envelope with postage for two ounces (that's currently $.32 + $.29 = $.61 in the U.S.) to: John Langner WB2OSZ, 115 Stedman St. #A, Chelmsford, MA 01824-1823.

Q: How can I get started with little or no investment?

A: Either dip into your junk box or take a few dollars to your local Radio Shack store, and build the circuit shown in Figure 1. This circuit simply takes the received audio, amplifies the signal, and sticks it into a status line of a serial port. Software measures the time between the zero crossings to determine the frequency. The software converts these tones into images on the screen.

The circuit shown here is the absolute bare minimum. There are many other minor variations on this theme using diodes for reverse voltage protection, capacitors or power filtering, and transformers for isolation. If you already have a HAMCOM, FAXCAP, SSC PC HF Facsimile, or AEA FAX demodulator they will all work with some and maybe all the software mentioned here.

Next, find some free software such as JVFAX, VESTER, or EZSSTV. Try looking in:

Internet ftp access:
oak.oakland.edu /pub/ham-radio/msdos
. . . others . . .

If all else fails, send $5 to me at the address listed earlier in this article for a copy of EZSSTV. Do *not* send a blank disk. RF

Parts List

Part	Description	RS Part #	$
U1	741 or similar op amp	276-007	0.79
R1	47k resistor	271-1342	0.39
C1	0.01 uF capacitor	272-131	0.49
J1	DB25S	276-1548	1.99
	or DB9S connector	276-1538	1.29
	Shielded cable for audio		

A well-stocked junk box has all of these items. Otherwise, you can get everything at your local Radio Shack store. The resistor and capacitor values are not at all critical. Use either a 25- or 9-pin connector, depending on the type of serial port available.

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For all DOS computers. Available thru dealers. 73 Magazine, QST, or send $29.95 + $3 S&H (CA residents add 7.75% tax) to: GGTE, P.O. Box 3405, Dept. MR, Newport Beach, CA 92659
Specify 5¼ or 3½ mdr disk

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CIRCLE 193 ON READER SERVICE CARD

the tech side

by Michael Jay Geier KB1UM

More "Buy Buy"

Last month, we were talking about buying ham equipment, starting with a 2 meter HT. Let's continue.

At Home

For base station operation, an HT works pretty well, unless you live very near some high-powered VHF transmitters, in which case you may have some serious receiver overload and intermod problems. Unlike mobile rigs, HTs are just too small to have much front-end filtering. With small antennas, it isn't a problem because signal levels aren't that high. Hook a handheld up to your rooftop skyhook, though, and you may find your receiver blocked or otherwise seriously degraded, due to strong signals which aren't even on the ham bands. In particular, paging services can really mess up reception on 2 meters, causing all kinds of bleeping and blooping all over the band, obscuring even strong repeaters and spoiling your fun.

There's no easy fix for this problem. If you don't live near any towers, however, you can probably use an HT at home quite successfully. I've got my dual-band walkie connected to a dual-band-pole rooftop antenna, and it works great. I live in the country, though, far from RF problems.

An external speaker is a big help, but you probably won't need any extra amplification at home. My HT's 200-milliwatt (0.2-watt) audio amp puts more than enough power into my Radio Shack communication speaker. In fact, I can't run it at more than about 1/2 volume or it gets uncomfortably loud.

While you can use a speaker-mike at home, too, the tiny speakers in most of them will be a bit unpleasant. A better choice is an external mike with no speaker, so you can use the one in the radio or a bigger external one. I have my HT connected to the same mike I use for my HF rig, via a switch.

If you plan any extended mobile or base operation, get a walkie which lets you lock the dial lamps on. All the new HTs I've seen use LEDs for the lamps, so they won't burn out. Naturally, you won't want to lock them on when you use batteries but, in the car or at home, it's very handy to keep them on.

Mobile VHF/UHF Rigs

For more rigorous base or mobile applications, a real mobile rig is the way to go. You just can't beat the combination of more transmit power and better receiver filtering. Where a walkie will be wiped out by intermod, a good mobile rig may show no traces of it at all. The difference can be striking. But what constitutes a "good" mobile rig?

Most modern mobile rigs are pretty good. While many offer RF output levels around 25 watts, you can get up to 50 watts if you need it. Do you? Probably not, unless you live or travel *way* out there. The difference between 25 and 50 watts is only 3 dB, which isn't that much at the receiver.

Speaking of receivers, they do vary somewhat, and you really want a good one when you operate in the car. Especially, look for good intermod and AM rejection. The intermod spec should be watched for the reason I mentioned above: You want to avoid being wiped out by paging services and such, which can be a real problem in big cities. Why the AM rejection issue, though? You'll be on FM anyway, right? In this case, we're not concerned with broadcast stations. Instead, we want to eliminate that great bugaboo of all mobile operation, ignition noise.

When your engine is operating, it puts out enough garbage to greatly reduce your radio's ability to hear the repeater. Heck, at your antenna the repeater's signal may only be at a level of a few microvolts (millionths of a volt). That's not much! Your engine, though, is only a few feet away from the antenna; its "signal" may be much stronger than that, perhaps hundreds of times as strong. Of course, the RF energy from the engine is spread over a great frequency range, so not that much of it is on the frequency you're trying to receive. Still, it can be a major problem.

Luckily, FM's greatest virtue is its ability to ignore noise, which is fundamentally different from the wiggles in the transmitter's carrier frequency (the FM, or frequency modulation) which convey the information you want. Essentially, noise is an amplitude phenomenon, not one of frequency. In other words, a noise spike, by momentarily adding its instantaneous voltage to that of the signal, changes the signal's *strength*, not its frequency. The ability of an FM receiver to reject the noise is called its AM rejection, and it should be as high as possible. I have an older mobile 2 meter radio which suffers greatly from poor AM rejection, and it sometimes makes operation while driving pretty uncomfortable: It takes a mighty strong signal to completely remove the static, and weak signals which would sound OK on a better radio can be so static-filled that I can't understand what people are saying.

Other Considerations

What else makes a good mobile rig? Well, ease of use is very important. When you're driving, there just isn't time to mess with complicated programming procedures. Just about all rigs are pretty easy to use once your operating frequencies are programmed into memory, so around-town operating is seldom a problem. If you travel out of your local area, though, it's entirely a different matter. Then, you may find yourself having to program on the fly, and the radio's user interface will really start to matter. If a rig is hard to use, requiring many button presses to get things up and running, you can become seriously distracted from your driving. So, when you shop for a rig, try programming in a frequency, offset and CTCSS tone, all while taking only occasional glances at the radio, as you would be forced to do in your car. If you can't do it, or it seems very hard, stay away from that radio. Between the different manufacturers, the user interface varies much more than the basic radio performance, so it's a very important qualification.

Then there's the matter of size. Will the rig fit where you want it to go? Proper placement is crucial, both because you need to be able to reach the radio to operate it, and because you don't want to make contact with it in a collision. That little piece of metal could, for instance, do serious injury to your knee in an otherwise minor crash.

Finally, to avoid a crash, you must be sure the microphone cord won't get in the way of your gearshift, steering or gas and brake pedals. Yes, that does happen.

Extended Coverage

Most new walkies and mobile rigs are capable of extended receive coverage. Many of them can cover wide ranges which include all kinds of public service frequencies. There is, however, a tradeoff for this seemingly wonderful feature. In order to get the receiver to cover such a wide range, the front end (the sensitive first stages) usually has either very wide filtering or none at all. That results in significantly greater intermod trouble than some older rigs had. While some rigs require a modification to enable the extended frequency coverage, not doing the modification doesn't help the intermod problem; it's inherent in the wideband design. Oh well, sometimes progress really isn't progress after all. There are some new radios which don't have extended coverage, and they do fare better in high-intermod areas. If you suspect you may run into this problem, see if you can get a friend to test his or her rig in your area. If it does, indeed, suffer from intermod, consider one of the extensionless radios, and get a scanner if you really want to listen to the public service frequencies. Of course, expect the scanner to have the same problem!

Base Stations

Once upon a time, you could buy a base station 2 meter FM rig. They don't make them anymore, because people preferred using a mobile rig with a power supply. Why? So they could also take the radio into the car. If you want a base rig, you'll have to buy a mobile and a power supply. Heck, that's what the old base rigs were anyway—they just put the power supply inside the case!

There still are some all-mode base rigs, though. By all-mode, I mean that the radio offers CW (Morse code), AM and, especially, SSB (single-sideband) voice operation along with the usual FM.

Although you can buy an all-mode mobile, too, they aren't nearly as plentiful or popular as straight FM rigs, thanks to their much higher cost. Also, most SSB is done with horizontally polarized antennas, and mobile whips are vertically polarized, making communications with horizontally-polarized base stations difficult.

Do you need an all-mode rig? That's up to you! If you plan to do satellite work, you'll need two of them, or one of the multiband all-modes specifically designed for satellite communications. Even if you're not interested in the space birds, though, an all-mode can be lots of fun. You will find other operators on VHF/UHF SSB and CW, doing weak-signal work, meteor scatter and other esoteric stuff. And, for a given amount of power, SSB can often be heard at a much greater distance. Far and away, though, most VHF/UHF hams are on FM, and FM is all you need for packet radio, too. So, to most of us, an all-mode is something of a frill, or at least a hope for the future.

Well, I think we've about covered the higher parts of the spectrum you're most likely to pursue. Next time, we'll look at HF. Until then, 73 from KB1UM RF

radio magic

by Michael Bryce WB8VGE

Winding Coils

We'll take a break from our tour of schematics this month to deal with a problem every ham runs into: how to wind coils!

Lucky for us, the days of plug-in coils for band changing are long gone, but if you like to build your own gear you'll run into all sorts of coils.

Today, the coils new hams will run into are wound on a small doughnut-shaped core called a toroid. A toroid core may be made of several different materials, depending on the amount of inductance required with a specific number of turns of wire.

There are many reasons why toroids are used. Two of the most popular are that they have a high inductance for a given size, and these cores are self-shielding. (There are plenty of charts and winding guides to help you figure out how many turns of what size wire will produce a given inductance. For this project, we'll not dig into that.) There are powdered iron and ferrite type cores, cores for high frequency use and others for high power. The list goes on and on.

How Do I Do It?

For many, the problem starts with the kit instructions telling the builder to wind 14 turns of bifilar wire on the green core. If you're new to building your own gear, that's an OHMYGOSH! I'll try and declaw this problem for you. But, this is one case where it is easier to do than to read. Figure 1 shows you how it's done, with some added notes, too.

Rule number one for winding cores is not to get bent out of shape. Most of the people I've talked to worry about winding the cores before the package even arrives from the supplier! Just sit back and apply a good heaping pile of common sense to the project.

The toroids used in most projects are about the size of a nickel. They may be either colored or blackish gray. And, they are shaped like a doughnut.

Before you start threading wire through the toroid, there are several things you must do. First, send your wife shopping (or your husband to the nudie bar), and the kids to the mall. Turn off the TV and take the phone off the hook. You don't want to be interrupted halfway through a coil.

For this example, we'll use just a single-wire winding. It's the easiest to do and very common in such circuits as filters and VFOs. Turns are counted on the inside of the core, and *not* on the outside. Every turn through the core's center is counted as one turn. For example, a wire running through the core (like a ring on a finger) counts as one turn.

Begin by allowing for plenty of lead length. It's a sad day indeed when you find out that you're about three turns short of wire. Insert either end of the wire through the center of the core. This will be the first lead. Now, as you count the turns from the inside of the core, thread the wire in and out of the core. Keep the wire tight, but don't pull it so hard that you stretch the wire. Wind the wire evenly around the core, unless directed to do otherwise by the instructions or design of the circuit. When the windings are spread over the outside of the core, they should be even with no overlapping of turns. The same goes for the inside winding, too. After the proper amount of turns have been threaded on, leave about two inches for the second lead. This completes the winding of this core.

However, there is one more thing you should do before you call it done. You have two roads to take: Either promptly mount the core on the PC board, or place it in a baggie with a note inside telling you what core this is, i.e. T21, T5, and so on. Nothing's worse than to spend all night long winding cores, only to get them mixed up!

Now for the part I hate—stripping the enamel off of the wire after the core has been wound. I've tried several methods, and have found the burn and strip easiest for me. I use a large soldering iron tip and a 45-watt soldering iron. I then melt a glob of solder to the tip of the iron. On the edge of my workbench, I pull the wire between the soldering iron tip and the workbench. Add a touch more solder if need be to transfer the heat of the soldering iron to the wire. After a couple of pulls the enamel burns off, leaving the wire slightly tinned in the process. There is one drawback to this method: It's hell on the workbench! You can also try scraping the enamel off with a knife, sanding it off with some sandpaper, or trying paint remover. No matter what method you use, be sure you don't nick the copper wire. It will break at the nick point sooner or later.

The bifilar-wound cores are wound the same way, but this time there are two (bi means two) wires wound at the same time. A trifilar-wound core uses three wires.

The Wire

It would be great if you had two different colors of the same gauge wire, but that's not the way life is. So, you use two wires, each the same color. I'll show you how to figure out which wire is what later on. You then twist the two together. A battery-powered screwdriver or drill is just great for this step. Here's how to make your own bifilar wire.

Anchor one end of the wire to something solid; a door knob is ideal. Pull off about three feet of wire. Thread it through a screw eye held in the drill's chuck. Loop the wire back to the door knob. Give the drill a couple of quick pulls on the trigger to twist the two pieces of wire together. Don't get too carried away—you don't want the wire so twisted that it kinks together. When you're done, cut off the wire from the screw eye and the door knob. In your hands you have instant bifilar wire. If you need trifilar wire, then use a third wire.

Wind this wire on the core just as you did with the single-strand wire, counting the turns on the inside of the core. When you're done, you'll have two leads on one end and two leads on the other. Remove the enamel from all four leads.

Now comes the fun part, finding what wire belongs to what wire. After you have removed the enamel, get your VOM and set it to read continuity. Clip onto one lead from either end. Now, by using the VOM, find the other end of the same wire; let's call this coil "A." Leave the leads long, about two inches. The other two wires will be coil "B." Cut these leads shorter, about one inch long. So, coil "A" has the long leads, coil "B" has the shorter leads. When the instructions call for a bifilar-wound core, the two windings usually connect together. Now take one of the long leads of coil "A" and push it aside. On the other set of leads, take a short "B" lead and push it aside. The two leads leftover, one long and one short, are the ends of coils "A" and "B." Twist these two together and you're done! Look at the core. The long lead is coil "A," the center tap is the connection between the two coils, and the short lead is from coil "B." No trouble at all when you sit down and think it out.

So, don't let something as simple as winding coils put off your interest in building your own rig. RF

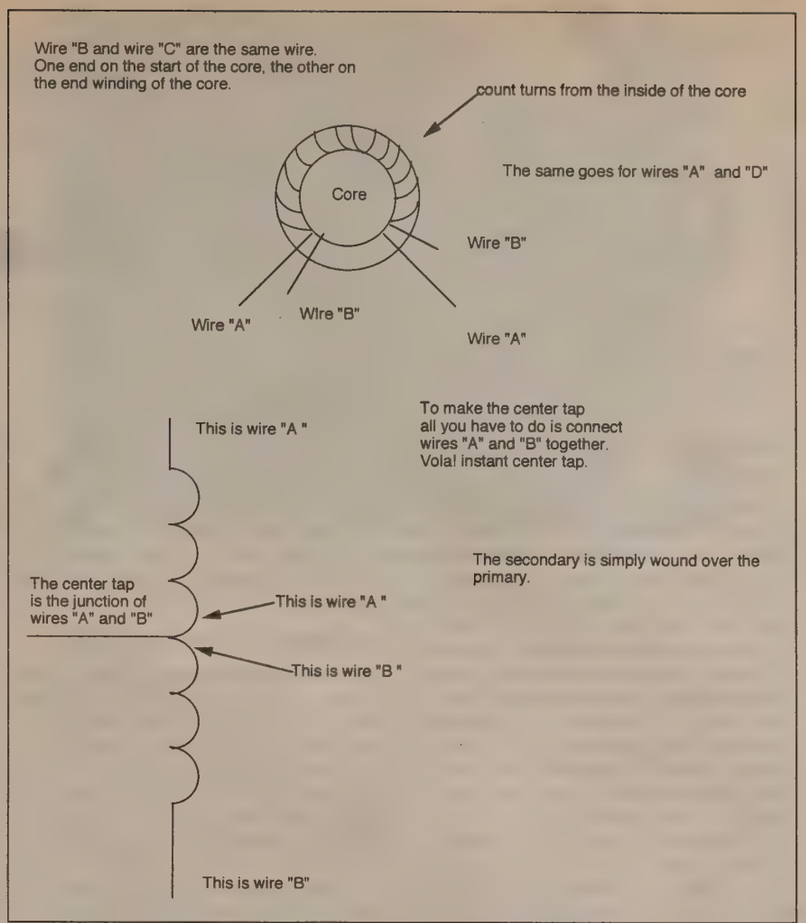
Wire "B and wire "C" are the same wire.
One end on the start of the core, the other on
the end winding of the core.
count turns from the inside of the core
The same goes for wires "A" and "D"
Core
Wire "B"
Wire "A"
Wire "B"
Wire "A"
To make the center tap
all you have to do is connect
wires "A" and "B" together.
Vola! instant center tap.
This is wire "A "
The secondary is simply wound over the
primary.
The center tap
is the junction of
wires "A" and "B"
This is wire "A "
This is wire "B "
This is wire "B"

Figure 1. Winding your own coils for fun and profit.

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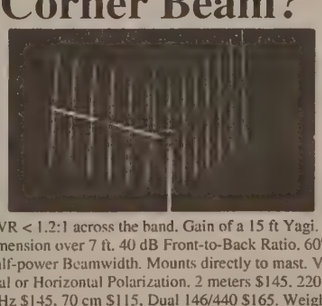

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antennas, etc.

by Joseph J. Carr K4IPV

Coaxial Cable Receiving Loop Antennas

Loop receiving antennas have been discussed in this column before, and their receiving properties are well worthwhile for radio amateurs. The neat trick with loop antennas is that they have a bidirectional "figure-eight" pattern with sharp, deep nulls perpendicular to the plane of the antenna. A characteristic of these antennas (as opposed to other forms of loop) is that the overall length is less than about 0.15 wavelength, or 0.15λ (with most textbooks saying less than 0.1 wavelength (0.1λ). Large loops have their maximas perpendicular to the antenna plane, while small loops have minima in that same direction.

The principal reason for using a small loop antenna on receive is to be able to null out interfering signals. Recall that the main issue is not how strong or how weak a desired signal is, but rather *how strong it is relative to other stations in the passband.* In other words, "signal-to-noise ratio" (SNR). Your receiver has all the sensitivity it needs to hear most of the "really weak ones." It may or may not have the dynamic range to overcome the gargantuan attack of huge numbers of strong signals that share the passband with desired signals. The loop antenna allows you to null out many of those co-channel bandcrushers, giving the desired signal a better SNR. It even works if the receive antenna reduces the strength of the desired signals (e.g. as with small loops), so long as the ratio between the reduction of the desired signal and the nulling of the undesired signals is favorable.

Receiving loop antennas can be built in a number of different ways, but most of those discussed in this column thus far have been coils of wire. In this month's column we will take a look at shielded loops made with a single turn of coaxial cable.

The Shielded Loop: Why and How

A shielded loop is preferable over non-shielded loops because it eliminates pattern distortion from capactive interaction with the local environment (ground, power wiring, etc.). It also shields the loop from local electrical interference. The reason that it does this neat trick is that it responds to the magnetic field of the radio signal's electromagentic wave (most antennas respond to the electric field), while local electrical interference tends to be due to electrical fields. Thus, the relative response of the loop to local electrical interference sources is less than it is to radio signals.

Figure 1 shows the construction of the coaxial cable loop. Notice that there are no length dimensions for the sides (or overall length). The dimensions are not critical, so long as the overall length does not exceed:

$$L_{feet} = \frac{98}{F_{MHz}}$$

Each side is one-fourth of this length. For example, at 1.8 MHz (160 meters), the overall *maximum* length is 54 feet, or 13.5 feet per side (if square configuration is used). At 14 MHz, the overall length is 7 feet, or 1.75 feet per side; at 29 MHz the overall length is 3.4 feet (41 inches), or 0.85 feet (10 inches) per side. Many practical antennas of this sort published in the ham literature are somewhat shorter (0.05λ) than these lengths.

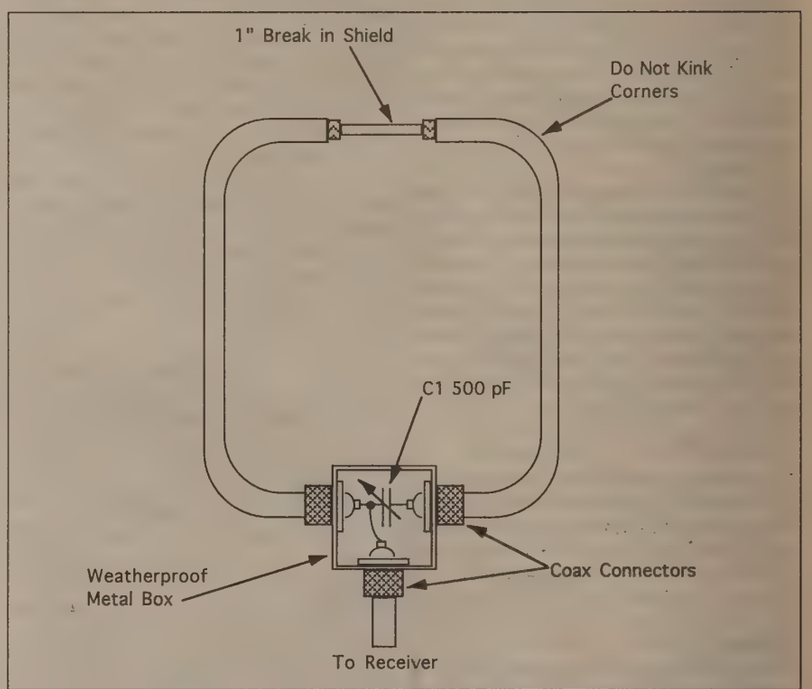

Figure 1. Coaxial loop antenna configuration.

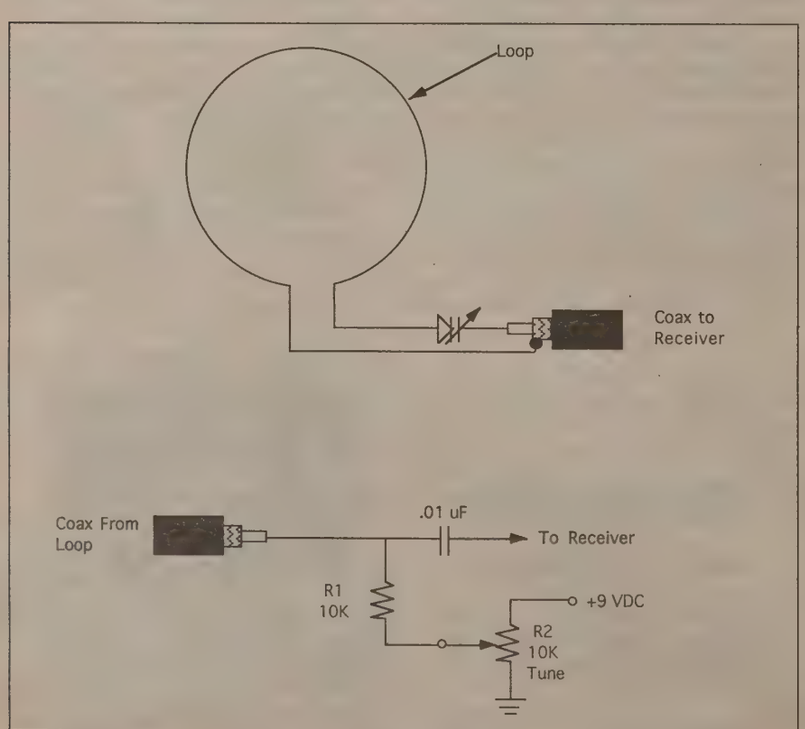

Figure 2. Voltage-tuning the loop.

The shape shown in Figure 1 is square, and this is probably the easiest to actually implement. A simple cross of 1 x 2 lumber can be used to make a frame for this form of antenna. However, circular antennas and triangle antennas could also be used.

The main feature of this antenna is the gap in the shield. This feature allows the antenna to respond to the magnetic field component of the radio signal, while blocking the electrical component. The gap is created by removing about 1 inch of the braided shield (outer conductor) from the coaxial cable, leaving only the inner conductor and its insulation.

At the feed end of the cable a waterproof metal (i.e. shielded) box is used to house the connectors and the tuning capacitor. This box can be an ordinary flanged aluminum box, but only if the seams are waterproofed with silicone seal, bathtub caulk, or some similar preparation.

The capacitor inside the tuning box is a smaller compression trimmer, or single section variable, with a maximum capacitance between 400 and 600 pF. This capacitor is tuned to the center of the band of interest, and generally does not need too much readjustment. If you want to be able to fine-tune the loop, then either use a small, low-RPM motor to turn the variable capacitor, or use a varactor scheme.

Figure 2 shows a varactor tuning scheme in which the antenna can be tuned from inside the shack. A varactor is a voltage-variable capacitance diode. In other words, the capacitance exhibited by the reverse biased diode is proportional to the applied DC voltage. For 440 pF, use the ECG-618, NTE-618, etc. You can obtain NTE-618 varactor diodes from Ocean State Electronics (POB 1458, 6 Industrial Drive, Westerly, RI 02891; 401-596-3080). If the capacitance of the NTE-440 isn't sufficient, then it's permissable to parallel small trimmer capacitors or fixed (ceramic or mica) capacitors across the varactor diode.

Almost any type of coaxial cable can be used. Most builders prefer RG-59 or RG-58 for larger or square loops (5-15 feet per side), and RG-8 and RG-11 for smaller circular loops (e.g. 14-30 MHz). The main selection factor should be ease of working the material during building the antenna, and ease of operation after it's finished.

If you are interested in further reading on loop antennas for receiving, then see my books *Receiving Antenna Handbook* (HighText Publications, Inc., POB 1489, Solona Beach CA 92075; 1-800-247-6553), and *Practical Antenna Handbook*, 2nd Edition, or *The ARRL Antenna Book* (last two available from Uncle Wayne's Bookshelf, page 27 of this issue). The Antlers software can be used to calculate conventional loop dimensions and resonating capacitances. Antlers for MS-DOS is $20, while Antlers 2.00 for Windows is $30. Contact me at P.O. Box 1099, Falls Church, VA 22041, if you want a copy of Antlers. RF

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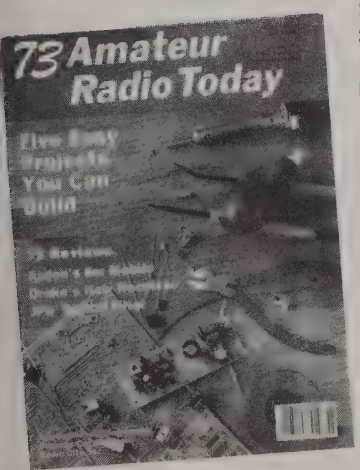

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what's next?

by Carole Perry WB2MGP

Photo A. Junior Girl Scout Troop 4885 of Medfield, Massachusetts, along with Troop Leader Donna Meaney, visits Arline Berry N1OMA on Girl Scout Thinking Day, February 22, 1994.

Girl Scouts and Ham Radio

On February 22, Girl Scouts and Girl Guides all over the world celebrate Thinking Day to honor the birthdays of Lord and Lady Baden-Powell. Lord Baden-Powell founded the Boy Scouts in England. His wife was World Chief Guide for the Girl Guides.

It is a day for celebration and for circling the globe with a chain of warm, friendly thoughts. The girls from Junior Troop #4885, Medfield, Massachusetts, Patriot's Trail Girl Scout Council visited Arline Berry N1OMA. They got to speak with a local YL ham radio operator on 2 meters. They also heard hams from Ireland and Germany.

I had the pleasure of meeting with Arline at the Boxboro Ham Radio Convention this past year in Massachusetts. I was very impressed with Arline's efforts in recruiting young ladies who are Girl Scouts into the ham radio hobby. She gave me some information about the Girl Scouts' background with ham radio and asked me to encourage others to help introduce the fun of radio contacts to local Boy and Girl Scout troops.

In 1913 the Girl Scout badges included signaling. The first handbook included requirements in Morse Code and Semaphore of at least 24 letters per minute.

In 1920 the signaling badge was continued. In addition, girls could earn the Telegrapher badge by passing the examination for the lowest-grade wireless operator according to U.S. Naval regulations.

In 1938 Transportation and Communication, an expanded badge, included post office operation, telephone service, telegraphy, early television, radio and weather reports, and transportation. It also included learning about inventors in the transportation and communication fields.

In 1947 the radio badge included activities like talking to people who work in this field, writing announcements, using sound effects, explaining how a radio works, and sending and receiving Morse Code at 5 words per minute.

In 1953, the Radio and Television badge included taking part in a radio/television broadcast. Girls learned radio and television terms such as frequency modulation, coaxial cable, and FCC. They got involved with examining the use of radio in police work and in airplane operations. One option made available to them was to become a ham radio operator.

The Radio and Television badge in 1963 enabled junior high school girls to explore various uses of radio and television transmission for ham radio, radio telephone, police radio, and closed circuit TV. There was career guidance and an opportunity to give service using the information learned.

For the 1980 Communications Arts badge, one requirement states, "Investigate ham radio and how it works. Learn how to get a license. If possible, see a ham radio in operation. Prepare a short broadcast for a ham radio operator to give when seeking help in a disaster. Use Morse Code."

In 1987, The Emergency Preparedness badge encouraged junior high school and high school girls to work with a ham radio operator at a shortwave radio station.

In 1990, the design of the badge was changed. The requirements remained the same except that the use of Morse Code was omitted.

Arline got this information from the Girl Scout Museum at Cedar Hill in Waltham, Massachusetts.

A new flier has been introduced to give information about ham radio to Girl Scouts. Arline Berry helped to develop the flier, and is acting as Volunteer Coordinator for Girl Scouts and Ham Radio, locally as well as nationwide.

Arline has developed a Patch Program for junior and cadette Girl Scouts. This program is designed to stimulate interest in finding out more about ham radio and where to find local licensing classes. When the ARRL receives a request about Scouts and ham radio, they forward information to the individual about the local ham radio clubs in their area. Information is also sent to the clubs about the troop or Girl Scout who is interested in more information about radio.

Plans are being made to set up a ham radio station at the National Girl Scout Convention in October 1996 in Fort Worth, Texas. Scouting and ham radio go hand in hand. JOTA (Jamboree On The Air) is an official Scouting event held every October where hams and Scouts from all over the world talk to each other and have a great time.

Further information about the Girl Scouts and ham radio can be obtained by contacting: Arline Berry N1OMA, 6 Causeway Lane, Medfield, MA 02052; (508)359-6656. RF

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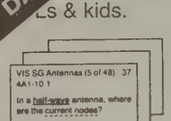

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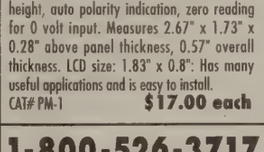

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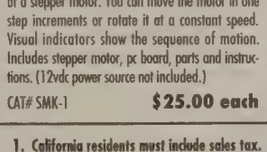

This kit allows you to adjust the speed and direction of a stepper motor. You can move the motor in one step increments or rotate it at a constant speed. Visual indicators show the sequence of motion. Includes stepper motor, pc board, parts and instructions. (12vdc power source not included.)
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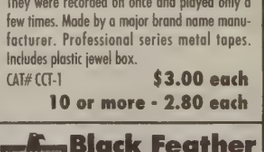

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Get Your Mobile Signal Out

How is that new single- or dual-band hand-held transceiver working? Are you getting good or bad signal reports when you run your hand-held in your car, truck, van, or motor home? If the reports are good, chances are you are using an external single- or dual-band antenna. If you're getting bad signal reports, you may be operating your handheld with just the little rubber antenna *inside* your vehicle. *This is not good!*

If you are transmitting with a little rubber antenna on your handheld inside your vehicle, more than half of the radio waves don't get out through the windows. The wavelength is relatively larger than most vehicle windows, so the waves are reflected back into everyone inside your car or motor home. This raises your exposure to radio frequency emissions and, let's face it, getting too much RF is just not good. The American National Standards Institute (ANSI) has actually established maximum power output limitations to amateur radio handhelds to not exceed 7 watts. This is 7 watts outside and in the open; if you are running 4 or 5 watts output with that little rubber antenna inside the vehicle, you may actually be exceeding American National Standards Institute limits for RF exposure.

"If you are transmitting with a little rubber antenna on your handheld inside your vehicle, more than half of the radio waves don't get out through the windows."

Use an Outside Antenna

The answer to good hand-held range inside a vehicle is an outside antenna. I can see your eyes rolling back right now—thinking that you might have to drill a hole in your brand-new vehicle to accommodate an outside antenna. Not necessary.

The following manufacturers offer HF and VHF/UHF antenna mounts specifically designed for a no-hole installation: Austin, Antenna Specialists, Comet, Cushcraft, Diamond,Hustler, Larsen, Maldol Power Mount, Valor.

The most popular mount for vehicles is the trunk-lip mount. Open up your trunk, slide the mount over the lip of the trunk, and close the trunk. To your amazement, nothing gets squished. The mount hangs on with recessed Allen screws, and this provides a good DC ground for the antenna you plan to run on the mount.

The trunk lip mount also features extremely small spaghetti-sized flexible coax for a few inches in order to clear the area that gets closed when the trunk is shut. This small coax then feeds into an extremely flexible but larger coax that offers minimal loss at VHF and UHF frequencies up to your hand-held radio. And now more good news—Japanese manufacturers have introduced a completely assembled coaxial cable connector assembly that screws on to become a PL-259 for fixed-mount radios, or screws onto a BNC connector for most handhelds, or to a TNC connector for special hand-held connections. All this without soldering!

You can also go with a gutter mount. These also hold on with two recessed Allen screws. Extremely small coax feeds in through a window, and then blends into larger coax that ultimately makes it up to the front of your vehicle where you plan to run your handheld.

On motor homes, you can get by with a less sophisticated mirror mount, or a simple L-bracket that hangs onto the side of your motor home. These "low-tech" mounts give you high performance because they get your antenna up and in the clear for good, solid VHF and UHF communications from your little hand-held transceiver inside. And for those of you with extremely tall vehicles or motor homes, you can even get a power mount, made by Maldol, which electronically raises and lowers the antenna in case you need to pass under a low bridge or get into a garage. And if you forget to power down the antenna, the properly-mounted Maldol has a slip joint that allows the antenna to fall back when struck by a low overhang without damage to the antenna or the inside of the mount.

When you hook the coax up to your new single- or dual-band handheld, you will be impressed with the performance of whatever type of antenna is atop the outside mount. Dual-band antennas come in a variety of lengths, but quite frankly almost any length dual-band antenna outside on a vehicle will give outstanding results. If you operate in a repeater fringe area, choose an antenna that is about one yard long. If you drive in cities, you can get by with an antenna that's only about one foot long. You can also have a selection of antennas—a short one for city use and a long one for out on the high road. Gain is commensurate with antenna length—the little one-footers offer about unity gain (3 dB a dvertised), and the yard-long ones offer about 3 dB gain (6 dB advertised).

When you switch from the little rubber antenna over to the coax that leads to an outside antenna, you will hear distant repeaters that you never knew were there before. You will also be able to access more repeaters more of the time than with the little rubber antenna inside. No longer will people be saying that your signal is "chopping out" when you are on an outside antenna. You will also decrease the amount of RF exposure to everyone inside the vehicle.

But one word of caution: If you are running the low-loss, larger coaxial cable to the top of your hand-held set, be careful not to stress the hand-held antenna connector. Manufacturers of single- and dual-band hand-held transceivers continue to hard-wire the connector directly to the circuit board, rather than provide a flexible wire attachment to the PCB. If you continually strain the connector, it will ultimately break loose from the circuit board and you will then have big handheld problems that will require a technician to go inside the unit to fix. And on some handhelds getting on the inside of the circuit board where the antenna attachment is made is a tough job—they're two layers of board deep! On other handhelds, it's a simple matter of removing the back of the transceiver, seeing where the solder trace has broken loose, and reattaching it with a small soldering iron.

I recommend a speaker microphone which lets you keep the handheld on your seat and free from tugging at the coax cable. But be cautious if you run 12 volts directly to the handheld as an external power source. While indeed this may conserve your handheld's battery, or on some handhelds actually charge the battery, it runs your unit at full power output, and the back of the handheld is going to get red hot. If you have the handheld sitting on the seat, it could actually melt the seat during long periods of transmit at high power off of external 12 volts. Not a good situation!

So never run a handheld transceiver with its little rubber antenna inside the vehicle—go outside for impressive results! RF

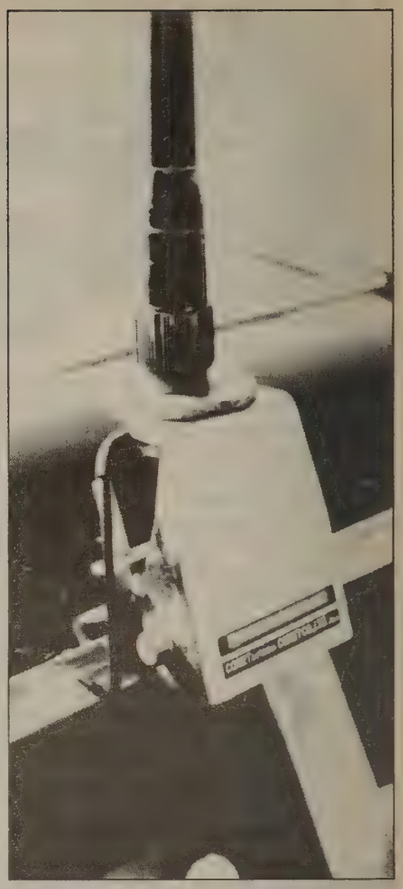

Photo A. It takes three minutes and no holes to get this mount into place on a gutter lip.

Photo B. The large low-loss coax feeds into small coax to feed through a trunk lip or window mount.

Photo C. For temporary use, use your handheld's antenna on a window mount.

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

W5GWNC **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

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TAB 339643 **Tuning In To RF Scanning** From Police to Satellite Bands. Bob Kay. 150p 1994, Tab Books. This is a wonderful book for the VHF-UHF scanner listener. It explains about the various radio bands, antennas, the laws, and lists frequencies for every imaginable service . . . including the Secret Service, FBI, military, IRS, prisons, Fish & Wildlife, McDonald's order windows, nuclear search teams, railroads, Russian satellites, Treasury Dept., wireless microphones for concerts, and so on. **$14.95.**

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WGP1234 **1995 International Callbook** The new 1994 International Callbook lists 500,000+ licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **$35.00**

DOV41 **Basic Electronics** *Prepared by the Bureau of Naval Personnel* Covers the important aspects of applied electronics and electronics communications. **$10.95**

DOV76 **Second Level Basic Electronics** *Prepared by the Bureau of Naval Personnel* Sequel to Basic Electronics, thorough treatment of the more advanced levels of applied electronics. **$9.95**

20N096 **How To Read Schematics (4th Ed.)** *by Donald E. Herrington* Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. **$19.95**

WLSWOCP **Radio Operator's World Atlas** *by Walt Stinson, WØCP* This is a compact (5x7), detailed, and comprehensive world atlas designed to be a constant desk top companion for radio operators. **$17.95**

TAB37109 **Secrets of RF Circuit Design** *by Joseph J. Carr* Written in clear non-technical language, covers everything from antennas to transistors. **$21.95**

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TAB11065-1 **Mastering Radio Frequency Circuits** by Joe Carr, 411 p. If you're interested in learning about radio components and circuits, this book is great! Plus there are a ton of simple circuits you can build. It explains how circuits work, about test equipment, receivers, the works. This will take a lot of the mystery out of how radios work...the easy way. This will be one of your better $20 ham investments. $20.00

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WG4 **20/20 Foresight**—Twenty 16p updates on the **Declare War** book—320p. Further proposals for solving critical American problems, such as a new approach to financing small businesses, how to finance Russia and other countries and make a profit doing it, the real dope on bioelectromagnetics, a new kind of polytechnical university, a new electronics technology, why Africa is in such a mess, why Perot bombed, how to have tuition-free universities, a plan for making Congress turn honest, etc. Plenty more. One of the best $10 you'll ever spend. Ridiculously priced at **$10**.

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ANTENNAS

UE220 **The Easy Wire Antenna Handbook** *by Dave Ingram K4TWJ.* Gives you all of the needed dimensions for a full range of easy to build and erect "sky wires." **$9.95**

WGP87034 **All About Cubical Quad Antennas** *by William Orr and Stuart Cowan* "The Classic" on **Quad** design, theory, construction, operation. New feed and matching systems. New data. **$11.95**

TAB 3270P **Practical Antenna Handbook**—Second Edition, 1994, Joseph Carr; Tab Books. This 560-page book is a real treasure. Joe starts with the fundamentals of antenna and feedline theory, explains about propagation of all kinds, and then provides a ton of easy antenna construction projects. It covers antennas and feeders for all bands. You'll have a ball with this book. By the way, the explanations are simple and well illustrated, with some math where it's unavoidable, but it won't bog you down. It even has the ZL-Special antenna, which I've used on 20m with some spectacular DXing success. It has an extraordinarily low angle of radiation and made it so I could always work the rare stuff first . . . Wayne. **$26.95.**

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activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

FEB 17-18

SALEM, OR The Salem Repeater Assn. and Oregon Coast Emergency Repeater Inc. will co-sponsor the 1995 Salem HamFair at the Polk County Fairgrounds in Rickreal OR. Time: 9 AM-4 PM. Set up 6 PM-9 PM Fri. night and 7 AM Sat. morning. Talk-in on the 146.86 Rptr. Contact *Evan Burroughs N7IFJ, (503) 585-5924.*

FEB 18

HORSEHEADS, NY The ARA of the Southern Tier will present a Hamfest at the NY State Armory, 128 Colonial Drive. Indoor Flea Market. New Equipment Displays. VE Exams start at 9 AM. Flea Market tables available on a first come basis. Doors open 7 AM-3 PM. Contact *Jack Slocum, (607) 739-4866.*

TRAVERSE CITY, MI The Cherryland ARC 22nd Annual Swap-N-Shop will be held 8 AM-Noon at the Immaculate Conception Middle School. VE Exams at 1 PM, walk-ins accepted. Talk-in on 146.860. Contact *Chuck Mellberg W8SGR, (616) 946-5312.*

FEB 19

DAVENPORT, IA The 24th annual Davenport (Iowa) ARC Hamfest will be at the QCCA Expo Center in Rock Island IL. Flea Market. Commercial Exhibits. Talk-in on the W0BXR 146.28/.88 Rptr. For reservations or details, send an SASE to *Kent Williams K9UQI, 4245 10th St., East Moline IL 61244.* For VE Exam info, send an SASE to *Roger Franke K9AYK, 2506 E. 29th Ct., Davenport IA 52803.*

FEB 25

BISMARCK, ND The Central Dakota ARC will hold its annual hamfest at the Radisson Inn, 800 South Third St., 8 AM-4 PM. Talk-in on 146.85/.25. Ve Exam. Ham/Computer Swapmeet. Contact *Tim N0SDB, (701) 553-6620;* or *Mark N0FAZ, (701) 255-7658.*

LAPORTE, IN The Laporte Civic Auditorium is the place to go in order to enjoy the Laporte Cabin Fever Hamfest. This event will be sponsored by the Laporte ARC 8 AM-2 PM (Chicago time). Computer enthusiasts welcome. Talk-in on 146.610 (-131.8 PL), or 146.520 simplex. Contact *TX John @ (219) 362-1121,* or SASE to *P.O. Box 30, Laporte IN 46351.*

MILTON, VT The Radio Amateurs of Northern Vermont will sponsor the Northern Vermont Winter Hamfest at Milton H.S. on Route 7. Time: 8 AM-3 PM. Flea Market. Auction. Book Sale, more. VE Exams at 9 AM and 2 PM; Commercial exams at 2 PM. Tables free while they last. Call for large setups. Talk-in on 145.14 Rptr. Contact *WB2J8J at (802) 879-6589.*

FEB 25-26

CINCINNATI, OH The 1995 ARRL Great Lakes Div. Convention will be held at the Cincinnati Gardens Exhibition Center, 2250 Seymour Ave. Exhibits open at 8:30 AM Sat. and Sun. For details, call *Stan Cohen WD8QDQ, (513) 531-1011.*

FEB 26

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC, Inc. will hold their 41st annual Hamfest/Computer Show and Flea Market at Emidio & Sons, 48 Bath Rd., 8 AM-3 PM. Set-up Sat., Feb. 25th. For details contact *Carl Hervol N8JLQ* or *Betti Hervol KB8PXS,* by phone *at (216) 497-7047.*

LIVONIA, MI Livonia ARC will present its 25th "Silver Anniversary" Swap'n Shop 8 AM-3 PM at the Dearborn Civic Center in Dearborn. VE Exams. Talk-in on 144.75/5.35. For info, send a 4" x 9" SASE, *c/o Neil Coffin WA8GWL, Livonia ARC, P.O. Box 2111, Livonia MI 48151,* or phone *(313) 261-5486.*

NEW BERLIN, WI A Swapfest and Computer Fair sponsored by SEWFARS, 146.820 Reptr. Soc., MACE, and The Milwaukee Computer Club, will be held at Kuglitsch's Entertainment Center at 16000 W. Cleveland Ave. VE Exams. Reservation deadline is Feb. 11th. Make checks payable to SEWFARS/MACE Swapfest, and mail with SASE to *P.O. Box 102, Delafield WI 53018. Tel. (414) 771-1250.* Talk-in on 146.820 Rptr. LLBBS (414) 789-1034.

VIENNA, VA The 19th ARRL sanctioned Vienna Wireless Soc. Winterfest will be held at the Vienna Comm. Center. VE Exams will be held on Feb. 25th. Talk-in on 146.91 and 146.685. For info please call *Christine KE4HWE, (703) 560-7399,* or *Jorge KE4DGQ, (703) 729-4711.*

MAR 4

ABSECON, NJ The Shore Points ARC will sponsor its 13th annual hamfest, "Springfest '95" at Holy Spirit HS, on Route 9 (3/4 mi. south of Route 30. Doors open at 9 AM. Setup at 7 AM. VE Exams registreation at 9:30 AM; testing at 10 AM. Flea Market. Talk-in on 146.385/.985. For info write to *SPARC, P.O. Box 142, Absecon NJ 08201.*

MAR 5

CLEVELAND, OH The Cleveland Winterfest will be at the Cuyahoga County Fairgrounds, Berea OH, 8 AM-2 PM. Set-up at 6 AM. VE Exams will be administered early; bring proper IDs, a copy of your license, and a check payable to ARRL/VEC. DXCC/WAS QSL Checking. Talk-in on 146.73. Contact *Hamfest Assn. of Cleveland, P.O. Box 81252, Cleveland OH 44181-0252. Tel. (800) CLEFEST (253-3378);* or *999-7388* in the Cleveland area.

NORTHAMPTON, MA The 11th annual MTARA Amateur Radio Flea Market will be held at Smith Vocational School, RTE 9. Setup 8 AM. General admission 9 AM. VE Exams 10 AM; contact *Jim WA1ZUH, (413) 245-3228,* or *@ MTMBBS via packet.* Advance registration strongly recommended. The vendor contact is *Jim K1MEA, (413) 527-3199, eves. before 2200 EST.*

MAR 10

ST. LOUIS, MO The Jefferson Barracks ARC will host their 35th annual Ham Radio Auction starting at 7:30 PM at Concordia Turners Hall, 6432 Gravois Ave. Talk-in on 146.34/.94 or 144.61/145.21. Contact *Carl H. Hohenberger WB0BZP, 5266 Parker Ave., St. Louis MO 63139-1340. Tel. (314) 351-7084.*

MAR 11

FARGO, ND Red River Radio Amateurs will present their Amateur Radio/Computer Electronics Fair at the West Fargo Fair Ground, 8 AM-3 PM. VE Exams start at 1 PM; pre-registration required. Talk-in on W0ILO 146.76(-). Contact *A.R.C.E.F. '95, P.O. Box 3215, Fargo ND 58108-3215.*

MAR 11-12

CHARLOTTE, NC The Mecklenburg ARS welcomes you to the 1995 Charlotte Hamfest/ComputerFair and ARRL Roanoke Div. Convention. Location: Charlotte Merchandise Mart, 2500 E. Independence Blvd., in Liberty Hall, (US 74). Hours: Sat. 9 AM-5 PM; Sun. 9 AM-2 PM. VEC FCC Exams Mar. 12th; pre-register, or walk-ins accepted as space permits. Contact *Charlotte Hamfest, P.O. Box 221136, Charlotte NC 28222-1136. Tel. (704) 841-HAMS.* Talk-in on W4BFB, 144.69/145.29.

MAR 12

BRISTOL, CT The Insurance City Rptr. Club Inc. will hold its annual Hamfest Flea Market from 9 AM-1 PM (snow date Mar. 19th), at Bristol Eastern H.S., King St. (RT 229). Talk-in on 146.88 and 224.80. To reserve tables, send an SASE to *Al Gerke N1JWF, 63 N. Washington St. Apt. 2, Plainville CT 06062-1921;* or call *(203) 747-1925.* VE Exams at 10 AM; no walk-ins. To register, send an SASE to *ICRC, P.O. Box 165, Pleasant Valley CT 06063.*

INDIANAPOLIS, IN The Indiana Hamfest & Computer Show will be held at Indiana State Fairground's Pavilion Bldg., by the Morgan County Rptr. Assn. Doors open at 8 AM. Talk-in on 147.06. For table reservations or info, send an SASE before Feb. 21st, to *Deanne Martin N9TEJ, 39 Lake Shore Dr. #14, Martinsville IN 46151. Tel. (317) 342-4307.*

YORK, PA The 8th annual York Springfest (Ham & Computer) will be held at the York Fairgrounds starting at 8 AM. W5YI VE Exams at 8 AM. Talk-in on 146.97(-). For info and advance registration, call *(717) 843-7864,* leave message or FAX, or write to *York Springfest, P.O. Box 526, Red Lion PA 17356.*

MAR 18-19

FORT WALTON BEACH, FL The Playground ARC will hold their 25th annual North Florida Ham/Swapfest at the Ft. Walton Beach Fair Grounds, 8 AM-5 PM on the 18th; 8 AM-3 PM on the 19th. Giant indoor Flea Market. For tables, call *Bud K8YNU, (904) 243-5404, 9 AM-5 PM CDT;* or *Scott KE4BFT, (904) 244-3182, 5 PM-9 PM CDT.* For RV space only, call *Roberta, (904) 862-0211.* Address all inquiries to *P.A.R.C., P.O. Box 873, Ft. Walton Bch. FL 32549.*

APR 28-30

DAYTON, OH The Dayton ARA Inc. will hold their annual HAMVENTION at Hara Arena. Giant 3 day Flea Market. Exhibits. Activities for the Non-Ham. *FAX: (513) 274-8369; FAX-Mail (513) 276-6934. BBS via America Online: (513) 276-6930, Keyword "Ham", select "Hamvention";* License exams by appointment only; call FAXMail or BBS for details. Mailing address *Hamvention, Box 964, Dayton OH 45401-0964.* Advance registration deadline is Apr. 1st for Canada, Apr. 8th for the USA. Flea Market tickets by advance registration only. Free bus service will be provided between Hamvention, Air Force Museum, Salem Mall and Forest Park Mall parking areas. Please call BBS or FAXMail for info.

SPECIAL EVENT STATIONS

FEB 18-19

MT. VERNON, VA The Mount Vernon ARC will operate Station N4BV from 1600Z-2000Z both days, to commemorate George Washington's birthday. The station will be located on Washington's Mt. Vernon Estate. Frequencies: Lower General 80m-15m phone and CW subbands, Novice 10m phone subband, and 2m packet @ WA3TAI.MD.USA.NOAM. For a certificate, send QSL and a 9" x 12" SASE to *Steve Schneider WB4EEA, 8602 Cushman Place, Alexandria VA 22308.*

FEB 25-26

GLENVIEW, ILL The Lake County (IL) RACES/ARES Group will operate N9US from 1500Z Feb. 25th-2100Z Feb. 26th, observing the end of flight operations at Glenview Naval Air Station after 58 years of naval air service. CW - 3.580, 7.036, 14.030, 21.140; Phone - 3.880, 7.280, 14.280, 21.320, 28.430; OSCAR 10/13 satellite 145.910; Packet 145.03. For a certificate, send QSL and a 9" x 12" SASE to *Lake County RACES/ARES, 1303 North Milwaukee Ave., Libertyville IL 60048.*

GRANDE PRAIRE, ALBERTA, CANADA Members of the Peace Country ARC will operate CQ6ARC from the site of the 1995 Canada Winter Games. Operation will be from 1700Z-2300Z each day, around 14.240 MHZ(+/-); also, Satellite AO-27 and FO-20; as conditions permit. For a certificate, send QSL and a 9" x 12" SASE to *CG6ARC, P.O. Box 767, Granada Prairie, Alberta, Canada T8V 3R5.*

VIRGINIA BEACH, VA The Virginia Beach ARC will operate WA4TGF 1400Z Mar. 25th-2000Z Mar. 26th, to commemorate the 104th Anniversary of the NORWEGIAN LADY. CW - 10 kHz up from the bottom of the Novice subbands; Phone - 3.880, 7.280, 14.280, 21.280, 28.363, and 146.550. For a certificate, send QSL and SASE to *VBARC, P.O. Box 62003, Virginia Beach VA 23462.*

MAR 11

KINCARDINE, ONT. CANADA Station VE3LPE will operate 1400Z-2200Z to commemorate the birthday of Albert Einstein, and the peaceful use of nuclear energy. Operation will be in the lower portion of the General 80, 40, 20, 15, and 10 meter subbands. For a certificate, send QSL and a 9" x 12" SASE to *Kevin Pickles VE3LPE, 638 Johnston Cresc., Kincardine, ONT N2Z 1S7, Canada.*

WICHITA FALLS, TX The Wichita ARS will hold its 15th annual Hamfest at the Wichita Falls Activity Center 8 AM-4 PM. Set-up Fri. Noon-8 PM or by appointment. Sat. Set-up 6 AM. For more info call *Steven Guerra WB5LCN, (817) 723-2159* or *(817) 723-6500.*

MAR 12-13

WATERFORD, WI The 1995 Wisconsin QSO Party will be on the air 1800Z Mar. 12-0100Z Mar. 13. Entries must be postmarked by Mar. 31st, 1995. Contact *Wisconsin QSO Party, West Allis RAC, P.O. Box 1072, Milwaukee WI 53201* for complete details.

MAR 18

MACON, GA The Macon ARC will operate W4BKM 1400Z-2300Z at the 13th annual Cherry Blossom Festival. Phone: 7.235, 14.235, and 21.335; CW: 7.135, 14.035, and 21.135. For a certificate send QSL and a 9" x 12" SASE to *Macon ARC, P.O. Box 4862, Macon GA 31208.*

Radio Fun flea market

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What You Missed in *73 Amateur Radio Today*

If you don't read the February issue of *73 Amateur Radio Today*, here is some of what you're missing:

• "Grounding and Lightning Protection," a special two-part series begins this month, written by Glen E. Zook W5UOJ. Part 1 explains how to protect your shack and yourself from lightning. Don't let nature's fury ruin your ham shack or your body . . . that could spoil your day. Next month: RF grounding.

• Build a dual bi-square loop for use on 20 and 2 meters. Frank Kamp K5DKZ shows you how to put together an easy wire antenna for two of amateur radio's most popular bands.

• "Reading Morse Code on your PC" by Robert L. Kurtz W6PRO is an updated and improved version of "World of the Brass Pounders," an article first published in 1978 in Wayne Green's *Kilobaud* magazine. The author has adapted his idea, which was based of the 6502 microprocessor, to the modern PC family of computers. Use this clever device to decipher Morse code right off the air or to improve your own fist.

• Marty Gammel KAØNAN shows you how to build your own "Cheap Dual-Band Yagi," a fine VHF/UHF beam made from old TV antennas.

• We have the best reviews in *73*, and this month Steve Katz WB2WIK/6 gives you a very thorough look at Yaesu's new FT-900AT HF Transceiver. The FT-900AT is the latest compact mobile rig from Yaesu and it features base station performance along with a detachable faceplate.

• Pete Putnam KT2B reviews Midland's Model 18-405 and 18-410 base station antennas. These verticals offer good VHF/UHF performance at a moderate price.

• February's *73* also features a review of the Down East Microwave DEM 144-28K and DEM 222-28K Linear Transverters from Pete Putnam KT2B. These units represent a big step forward in transverter design. Get on all-mode VHF and UHF with that faithful HF rig you're already familiar with. It is a lot cheaper to consider a transverter—but is it right for you?

• Steve Katz WB2WIK/6 has also provided us with an excellent review of the Sentech Model Q144-8 2 meter Quagi antenna. Wayne Overbeck N6NB, inventer of the Quagi, happens to be a friend of Steve's, and in the spirit of ham radio, he lends his insight to this review. By the way, if you've never seen one, a Quagi kinda looks like the offspring of a quad and a yagi.

•A lot of people have been asking about Radio Shack's DSP-40 add-on digital signal processor, so this month Don Johnson K7UGQ reviews all the features and reports on its performance.

• As always, *73* brings you the best columns every month! In February's "Hamsats," Andy McAlister WA5ZIB brings you the latest on UoSAT-D and on the WiSP for Windows program. In addition to doing all the things you expect in 9600 baud satellite operation, WiSP also contains tracking software, drivers for rotator interfaces, event scheduling, and message composition. You should see all the beautiful pictures sent via satellite as digital files!

• Joe Carr K4IPV looks at filter design software in this month's "Carr's Corner." Check out Joe's look at Filtech from Number One Systems, Ltd.

• Dr. Mark I. Leavey, M.D., WA3AJR takes a diversion in this month's "RTTY Loop." Mark digs into his mailbag to answer whatever the readers want to know. Readers like you.

You should read the February issue, and *every* issue of ***73 Amateur Radio Today!*** Order now and save $15 off the cover price. You'll receive a one-year subscription (12 issues in all) to the best ham magazine money can buy, for just $19.97. For instant service call toll-free (800) 289-0388. Do it today! RF

Why Militant Gays Hate *73* Magazine

Militant gay activists are angry over Wayne's editorials taking them to task for suing the ARRL because the League refused to carry ads in *QST* soliciting membership in their gay ham group. Wayne has made it clear in his editorials that he thinks ham suers are ham sewers and the lowest of the low. "This is a hobby, so let's let the lawyers make their money elsewhere," he says. He also believes in the freedom of the press, and part of that is the right of publishers to decline any ads without having to give a reason. The gay group had previously presented Wayne with their appreciation award for running their ads in *73*.

The first thing most *73* subscribers read every month is Wayne's editorial, where he calls a spade a spade. His editorials not only discuss every aspect of amateur radio, but he even gets you to thinking about things like cold fusion, computers, Amelia Earhart, welfare reform, school reform, health care reform, politics, religion, and so on. The operative here is that he gets you to think. When's the last time that happened?

Other Benefits

If you check out the other ham rags you'll find that *73* not only publishes more new equipment reviews than they do, it publishes them months earlier. You *do* want to know what users think of the new stuff, don't you? One of the more fun aspects of hamming is buying a new piece of equipment and putting it on the air.

Then there's your need for a reference library when you get interested in some new aspect of the hobby. Suddenly you want to find out everything you can about packet, ATV, SSTV, or our many ham satellites. That's when the value of your ham reference library becomes important. And since *73* covers every ham interest, not mainly contests (like *CQ*) or club news (like *QST*), your back issues are a gold mine.

Yes, Wayne can be a nag, trying to get you out of your rut, or to lose weight or stop smoking so you'll live longer (and happier). Rag-chewing is fine. So's making 30-second totally sterile DX contacts just so you can collect a QSL card. Or beating your brains out in contests. But our hobby has much more than that to offer and Wayne will be after you to try something new.

If you haven't discovered the fun of building stuff you've got a whole new experience ahead of you. *73* publishes more simple home construction projects than all the other ham rags combined. There are a ton of wonderful ham kits being offered these days, making it easier to get the parts you need to build things at home.

So there you have it. Thought-provoking (or just plain provoking) editorials, lots of construction articles, a ton of antenna projects, and more equipment reviews than any other magazine. You'll never be short of interesting things to talk about on the air if you subscribe to *73*. Procrastination is the thief of fun, so put your credit card number on the subscription form and send it in, or call the 800-number. Let's get started.

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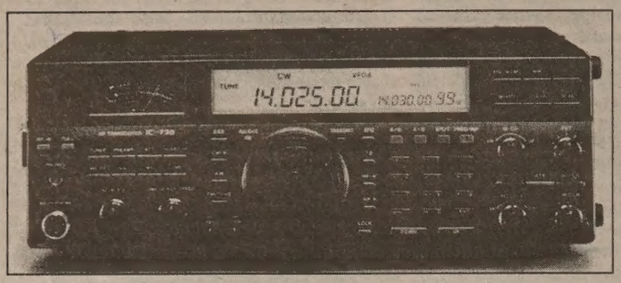
new products



ICOM

Work all the HF bands and receive 300 kHz to 29.995 MHz with Icom's *next generation* IC-738 transceiver. SSB, CW, AM, and FM are built into this rig, which provides a full 100 watts output (40 watts in FM). A heat sink with two large cooling fans ensures stable 100% duty cycle operation—great for DXing marathons.

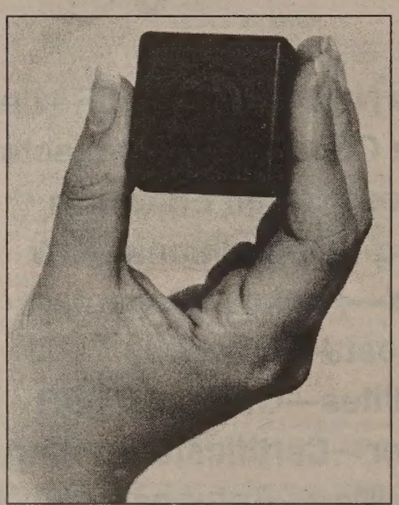
The IC-738 incorporates *next generation* circuitry with ICOM's unique Direct Digital Synthesizer (DDS) IC. High-tech and compact, the PLL unit provides precise frequency resolution to 1 Hz. Other features include a built-in antenna tuner, Double Band Stacking Register (DBSR), three scanning functions, passband tuning (PBT), and a notch filter.

The suggested retail price for the IC-738 is $1,935. For more information, please visit your favorite dealer or contact *ICOM America, Inc., 2380-116th Avenue N.E., Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

CCTV

CCTV Corporation has announced the introduction of the GBC CCD-600PH Pincam. This new camera's revolutionary design will allow users to place the camera virtually anywhere for completely undetectable surveillance and many ATV applications. The camera is 1-1/2"W x 1-1/2"D x 3/4"D. The Pincam's ultra-miniature size is enhanced by the built-in 3.6mm or 5.5mm pinhole lens.

This camera's built-in electronic shutter automatically compensates for lighting changes. Simply mount the camera behind a 1/16" hole to obtain a clear picture. The Pincam's resolution is over 400, lines with a sensitivity of 0.2 lux. For more information contact *CCTV Corp., 280 Huyler Street, South Hackensack, NJ 07606; 201-489-9595, 800-221-2240, FAX 201-489-0111.* Or circle Reader Service No. 206.



AEA

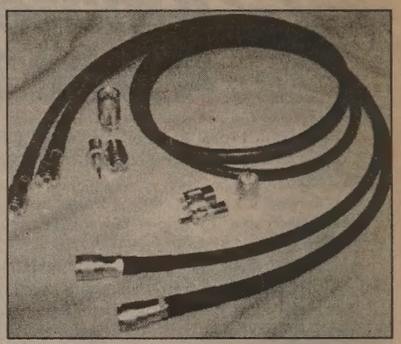
Advanced Electronic Applications has begun shipping the new AEA FAX III. The AEA FAX III is a stand-alone, multi-intensity, grayscale, HF weather fax demodulator and display software package. This product allows amateurs to colorize received weather fax images. This pseudo-color feature allows users to choose from 256 colors to clarify images or just to make them more appealing. Export to GIF or PCX files for manipulation in other graphics programs, then include them in newsletters, letters, or other publications.

This IBM-compatible software receives satellite maps and WEFAX images in 16 levels of gray. It also receives and decodes CW, RTTY, and NAVTEX transmissions. There are many more features, too. The suggested retail price is $149. For more information, please visit your favorite dealer or contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; 206-774-5554, FAX 206-775-2340.* Or circle Reader Service No. 207.

CABLE X-PERTS

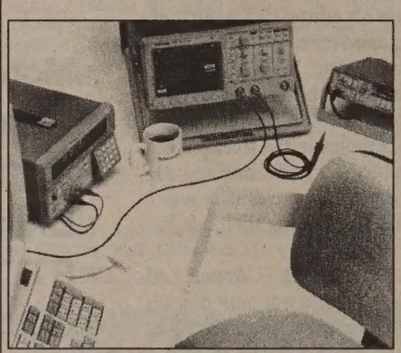
CABLE X-PERTS has a new 1995 catalog available for interested amateurs. This catalog provides a lot of technical information on coax cable and related products, prices included. In addition, CABLE X-PERTS has a solution for hams who have difficulty installing PL259 or N-type connectors. The company will install these connectors at $5 per connection plus the cost of the connector on any of their coax cables (except LMR series). All connections are soldered, HI-POT tested, continuity-checked, and sealed with UV-resistant heat-shrink tubing. Normal turnaround time is 10 business days.

For a catalog, please mail a Self-Addressed Stamped Envelope (SASE). For more information contact *CABLE X-PERTS, Inc., 113 McHenry Rd., Suite 240, Buffalo Grove, IL 60089-1797; (800) 828-3340 (orders only), (708) 506-1886 (technical info), (708) 506-1970 (FAX).* Or circle Reader Service No. 204.



TEKTRONIX

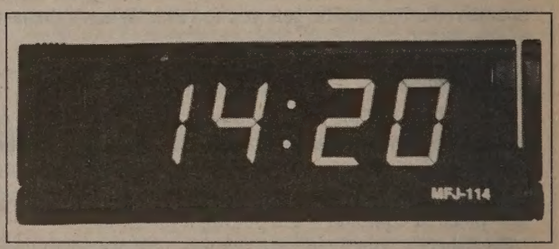
Tektronix, a leader in oscilloscope technology and instrumentation for nearly 50 years, has introduced a complete portfolio of products called TekBench, representing high-value low-cost products. More than 40 different basic test and measurement products are available in the TekBench portfolio, including oscilloscopes, function generators, universal counters and counter/timers, bench-top multimeters, power supplies, and measurement accessories.



All TekBench instruments are compatible, fully integrated, and have a uniform look and feel for simple, easy use by folks with a wide range of technical skills. For the name of an authorized dealer call 1-800-426-2200 (press "1" when prompted). Or contact *Tektronix, P.O. Box 500, Beaverton, OR 97077-0001.* Or circle Reader Service No. 203.

MFJ

MFJ Enterprises has introduced the MFJ-114 12/24-hour 2.3" LED digit clock. This clock is so large it could time a football game, but it is really made for the ham shack. This clock features giant 2.3" red LED digits—nearly the width of a 2 meter handheld. The display is especially bright, too.

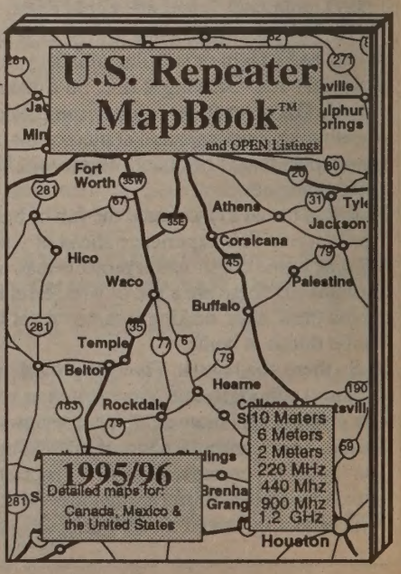


The MFJ-114 can be mounted to the wall or the ceiling, and the clock is easy to operate. It is powered from house current and features a battery backup. The price is $39.95. For more information or to order, visit your favorite dealer or contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (601) 323-5869, FAX (601) 323-6551, or toll free 800-647-1800 (orders only).* Or circle Reader Service No. 205.

ARTSCI

ARTSCI's *1995/1996 U.S. Repeater MapBook* is the perfect traveling companion for the radio enthusiast. This 5th edition has been totally redesigned to better serve the traveling amateur. New highly detailed maps enhance the presentation of the popular amateur repeaters. In an effort to show every open repeater, a detailed city-by-city listing accompanies every state map.

Maps show all major highways and cities in each state. New in this year's edition are table listings of all open repeaters in each state. Ask for the new *MapBook* at your favorite dealer or contact *ARTSCI Inc., P.O. Box 1428, Burbank, CA 91507; (818) 843-4080, FAX (818) 846-2298.* Or circle Reader Service No. 202.



DAYTON hamvention® '95

April 28, 29,30, 1995

General Chairman, Ken Allen, KB8KE

Asst. General Chairman, Dick Miller, N8CBU

✷ Giant 3 day Flea Market ✷ Exhibits ✷ Activities for the Non-Ham

When and Where

April 28, 29 and 30, 1995; Dayton, Ohio at Hara Arena

Communications

FAXMail (information sent to you via FAX): (513) 276-6934

BBS via America Online: Keyword "Ham", Select "Hamvention"

PHONE: (513) 276-6930. For fast response, please obtain the committee Voice Mail box numbers via FAXMail or BBS.

FAX (incoming): (513) 274-8369

MAIL: Hamvention, Box 964, Dayton, Ohio 45401-0964

Special Services

Lodging information and special award nomination forms are in our 1994 Program. Call FAXMail or BBS for more information.

License Exam by appointment only. Call FAXMail or BBS for details.

Deadlines

In order to have time to return tickets to you, we must have advanced reservation orders postmarked not later than April 8 (USA) or April 1 (Canada). Tickets will not be mailed before January 15th, 1995. Ticket requests that are received **AFTER** the deadline will be processed and **HELD** for pick-up at Hara Arena. Tickets can be picked up beginning Thursday, April 27 at 8:00 a.m.

Flea Market

Flea Market Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. A maximum of 3 spaces per person (non-transferable). Electricity is available in a portion of the last Flea Market row for $40 additional per space. Rental tables and chairs are not available in the Flea Market. Vendors ***MUST*** order an admission ticket for each person when ordering Flea Market spaces. Please send a separate check for Flea Market space(s) and admission ticket(s). Spaces will be allocated by the Hamvention committee from orders received by February 1. Please use 1st class mail *only*.

Notification of Flea Market space assignment will be mailed by **March 15, 1995**. Checks will not be deposited until after the selection process is complete. Please indicate in the box below if you would like to attend regardless of Flea Market space assignment.

Free bus service

Free bus service will be provided between Hamvention, Air Force Museum, Salem Mall and Forest Park Mall parking areas. We are investigating ways to improve service to hotels. Please call our BBS or FAXMail for specific information.

Returned Checks

A $20 service charge will be assessed on all returned checks.

HAMVENTION Is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration

Enclose check or money order for amount indicated in U.S. dollars and type or print your name and address clearly.

Make checks payable to:

Dayton HAMVENTION Mail to -

Dayton Hamvention Box 1446, Dayton, OH 45401-1446

Flea Market tickets *Please check one and enclose **two** checks.*

❑ Send admission tickets **only** if flea market space(s) assigned.

❑ Send admission tickets **regardless** of flea market space assignment.

	How Many		
Admission (valid all 3 days)	_____	@ $12.00*	$_____
Grand Banquet	_____	@ $23.00**	$_____
Alternate Activities			
Saturday Luncheon	_____	@ $9.00	$_____
Sunday Luncheon	_____	@ $8.00	$_____
Flea Market ‡	_____	$35/1 space	
(Max.3 spaces)	_____	$70/2 adjacent	
	_____	$160/3 adjacent	$_____
Electricity add	_____	$40.00/space	$_____
Covered tent	_____	$230.00 ea.	$_____
		Total	$_____

Name _____ Call _____

Address _____

City _____ State _____ Zip+4 _____ – _____

Daytime Phone # ( )_____ Evening Phone # ( ) _____

* $15.00 at door

**$25.00 at door, if available

‡ Admission ticket must be ordered with flea market spaces

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Cloning allows you to copy all memory channel information from one TH-79A(D) to another TH-79A(D)

TH-79A (Deluxe)
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Information at your fingertips. Everything you need to know about operating the new TH-79A(D) FM dual-bander (144MHz/440MHz) can be viewed in its unique dot-matrix LCD with alphanumeric display. No need for the manual. In addition to this innovative guide function, the TH-79A(D) sports a user-friendly menu system, providing easy access to the many powerful features of this slim-line handheld transceiver. Such as 82 non-volatile memory channels with ID, DTSS and page functions, and a DTMF memory function for auto-dial operation. Full-crossband duplex operation is available, as is the ability to receive two frequencies on the same band (VHF+VHF or UHF+UHF) simultaneously. And thanks to the FET power module, long hours of operation are possible on one charge. With the TH-79A(D), transceiver technology enters the 21st century.

Features

- 2.7W approx. output (144MHz), 2W approx. output (440MHz) from MOS FET power module and supplied 6V battery; 5W approx. output using optional PB-34
- Dot-matrix LCD with menu/guide system
- 82 non-volatile memory channels with ID
- DTMF keypad with memory function
- DTSS (Dual-Tone Squelch System) with page
- Built-in CTCSS tone encoder/decoder
- Automatic band change
- Power-on call sign display
- Auto repeater offset (VHF)
- *Wide-range flexible antenna*
- Input overvoltage warning
- 3-position output power control
- Auto power-off and battery save function
- Time-out timer
- *Memory channel lock-out (scan mode)*
- Cross-band repeater function
- Page answer-back function
- Channel display function
- Wideband receiver coverage, including AM receive on the aircraft band*
- Clone function
- Modifiable for MARS/CAP use**

*Specifications guaranteed for Amateur bands only.
**Permits required. Specifications guaranteed for Amateur bands only.

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